THE

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PEAT, IRELAND'S SALVATION?

How many readers will say to themselves before they begin this article: Here is another chimera, another bubble for the pricking; or, once more the ELECTRICAL REVIEW enters the lists against the fraudulent company promoter. Yet all we think of doing is to draw attention to Mr. Tomlinson's address to the Dublin Section, the author being a clean engineer who would as soon drink the turbid water of the Liffey between the bridges, as lend his name willingly to an unsound engineering project. Doubtless he is burningly enthusiastic, and he would be the last person to dissemble his connection with a Power Bill which will be presented to Parliament shortly, with the object of using for the production of electricity that dreary waste known as the Bog of Allen.

To an engineer travelling through country of a similar character, it is driven home, with a force which cannot be appreciated by anyone who is not acquainted at first hand with the characteristics of these millions of all but waste acres, what a tremendous difference it would make to the country if any considerable portion of the bog could be converted to useful ends.

The train carries the traveller through mile after mile of flat, marshy land covered with gorse and whin, bracken and ling, harsh reeds and barren rocks. A thatched and whitewashed miserable cottage, set in the midst of a filthy yard circumscribed by low, loose-piled grey granite walls, appears at long intervals, the face of the bog near by being exposed where the cotters have cut their turf for years, while a goat or an ass browsing on the beard of the common keeps itself in better fettle than its master.

Occasionally the train stops at a station near which there may be half-a-dozen poor houses, but few signs of trade or even of internal industry. To get enough turf for the winter's fire, to produce degenerate potatoes from exhausted ground, to keep a lean pig on the scraps that can be spared but ill from the cheerless table, and to send any male children who are in the least fit to America or Canada, as soon as they can hope to make a living; these are the occupations, that is the ambition of the listless natives of the bog country. Hampered by their poverty, degenerate in their type after generations of mal-nutrition, tied to the unkind bog from lack of opportunity, ignorant and narrow as a natural result of their environment and isolation, the peasant is only a power in the political world, and never can be anything else until the very face of the country is changed.

One seventh of the whole land is bog, and a great deal of the rest is infertile from other causes. What if the barren could be made fruitful, and the people prosperous by turning the hand of the enemy against itself? The idea is one which has burned brilliantly enough to attract many moths, whose wings, alas, have been singed; but hope or desire never

dies, and it may be that an adventurer equipped for the flight with something more mechanical than feather and gauzy film may attain the goal for which so many have striven in vain.

Whether Mr. Tomlinson and his associates in the latest scheme for utilising the most easily got, and the most hardly burned commercial fuel in the world, are pre-ordained to win the coveted prize, and thereby to confer an everlasting benefit on Ireland, remains to be seen; but, at least, we who look on may commit ourselves so far as to say that not until now has the prospect of success looked so bright.

To the layman the problem is so simple and is so difficult. There is the peat lying like a black wet blanket over vast areas, simply waiting to be got, the sections being greatly deeper than anything met in coal seams. The wetness of the blanket is the trouble, for so great are its absorptive powers that 90 per cent. of its bulk is water. Air drying may reduce this (probably under favourable circumstances) to 70 per cent., and it can be fed into the producer with as much as 40 per cent. to 45 per cent. of contained moisture. The trouble is to be rid of the 25 per cent. to 30 per cent. between, and Mr. Tomlinson's paper is full of figures which have satisfied him, and, incidentally, the eminent authority on gas producers who is helping him, that this moisture can be evaporated by the waste heat of the gas engines.

The backbone of each new scheme has been a positive solution of the drying problem, but nothing yet done in Ireland has justified the hopes of the promoters, and the public who have supplied the wherewithal to carry out experiments on a commercial scale have grown a-weary of the same old song in new settings and in different keys, and respond ever less and less readily to fresh demands on their purses.

Mr. Tomlinson is as positive of success as his forerunners. His enthusiasm is the genuine product of an engineer who has gone into the reasons for past failures, besides making a discriminatory acquaintance with all known modern systems of peat conversion, which in itself is a not-to-be-despised nucleus for another venture.

Although it is generally believed that the Mond gas power scheme in South Staffordshire has been at least a partial failure, Mr. Mond's opinions on the production of gas and by-products from any fuel must always command attention, and reference to Mr. Tomlinson's paper, which is abstracted in another column, will show that a large scale experiment in driving gas engines and making ammonium sulphate from peat obtained from Italy was so successful at the Brunner-Mond works, that a large plant is now being made for an Italian company.

It is the production of ammonium sulphate which makes possible the use of peat in this manner, and Mr. Tomlinson estimates that its sale in Ireland will enable the peat to be put into the producer free of cost; that is to say, the sulphate will pay for getting and carrying the peat.

The imaginative eye now sees the land which was once covered with useless bog growths, tilled and supporting rich crops at the expense of the peat, which is now such a curse, for to what better use could the sulphate be put than to fertilise the peat that remains?

The cultivation of these waste lands is as much a matter of drainage as of enrichment, but the peat will provide cheap power by which the water can be removed.

Is not this verily the turning of the enemy's hand against himself?

To come to more practical consideration, we imagine it to be essential to the success of a power scheme of this nature that it should start on a large scale, and we have great fears that the promoters must steel themselves to face lean years before their labours are rewarded adequately. Even if it be granted that a horse-power-hour can be produced at a very low rate, there is, unfortunately, as several electric power companies have proved to their cost, no such certain ground for assuming that it can be sold, and the production of sulphate alone is not going to pay for much more than the fuel. The South Staffordshire Power Gas Co. found that blowing the gas which they had to make into the air was a poor game, but it has to be done until customers are willing to take it, whether as gas or as the product of a gas-dynamo.

There is room on the Bog of Allen for factories galore, and the district is served fairly well with roads, canals and railways. Will the undoubted advantages of a cheap supply of power attract manufacturers to the neighbourhood of the power station? In time, no doubt, they would come, but meanwhile revenue must be sought at the ends of long transmission lines involving a very heavy initial outlay to correspond with the necessarily large power station.

All our sympathy is with Mr. Tomlinson and his co-workers, and we could wish for their sakes, and for the sake of Ireland, that we did not see so many difficulties ahead. Nothing will please us more than to know in a few years' time that we have croaked without due cause, and without taking sufficiently into consideration "those rare combined gifts of scientific insight, self-confidence and iron resolution with which Nature dowers a man when she has new and difficult work to be done."

A Government Electrical Monopoly in Germany.

The fantastical idea of converting both the manufacturing and supply business in Germany into a Government monopoly has actually been raised by one or two newspapers published in that country. At present State monopolies and new taxes are the order of the day for the purpose of providing funds, in order to meet the increasing national expenditure for a variety of objects. Why then, it is suggested, should not the electrical industry be included in the programme of Government monopolies, seeing that it would yield an enormous revenue? Yet the idea, which has also formed the subject of professional discourse at the Universities, would appear not to be of such a dreamy character after all, having regard to statements which are reported to have been made by officials of the Imperial Treasury and of the Ministry of Public Works and Railways. Thus, at the Treasury Office in Berlin a newspaper representative was informed, on making inquiries into the subject, that the establishment of an electricity monopoly would yield extraordinarily high receipts to the State Treasury. Of course an enormous capital would be necessary to purchase the whole of the electrical works situated in Germany, the number of which exceeds 2,000, of which 800 supply electricity. Among these works are to be found establishments having a world reputation, which alone represent a value of many millions of marks. It is considered that the money requisite for the purchase and working would quickly be covered by means of a loan, as

those who provided capital for an electricity monopoly would incur no risk, and a high rate of interest would be paid in view of the presumably high revenue. The Government, the Treasury official further declared, is also in sympathy with the idea of an electricity monopoly because the industry has not so many small works to show as in other trades. The workmen and officials would only derive advantage from the transfer of the undertakings to the State, as apart from being Government officials the State could guarantee them a more assured old age pension than the employés obtain with the individual private undertakings at the present time. At the Ministry of Public Works an official confirmed the idea that the institution of a monopoly would be a large source of revenue to the State. The official added that it was possible that the recent visit to the United States of Herr Wittfeld and other representatives of the Public Works and Railway Department, was connected with the scheme for the introduction of an electrical monopoly. A Berlin newspaper, in commenting upon the proposal as not being wholly fantastical in presence of the above views, condemns the project entirely on the ground that it would participate in the defects of other monopolies, as it would exclude private enterprise, would immensely increase the already excessive army of Government officials and workmen, and would consequently narrow economic liberty. But as the nation is only at the beginning of the work of utilising electric power, it is feared that the bureaucratic management of the industry would bring development completely to a standstill. This state of affairs would arise in the event of large receipts being drawn from such a monopoly, such as has been suggested at the two Governmental departments, as in this case the cost of electric power would be increased, whereas the whole tendency, it is considered, should be in the direction of reducing the cost to consumers. We do not observe any other reference to the suggested transfer of the manufacturing works to the State, although it is plainly outlined in the statements made by the Treasury official as previously mentioned.

Coal-cutting Machinery.

From the "Mines and Quarries General Report and Statistics for 1906" we learn that coal-cutting machinery is making rapid headway, no less than 10,202,506 tons of coal having been obtained by such machines in 1906 as against 8,102,197 tons in 1905, and 5,744,044 in 1904, being nearly 100 per cent. increase over the latter year.

The type of machine most in favour is the longwall cutter, there being no fewer than 845 of these out of a total of 1,136, the remainder being made up of 254 "percussive" machines, and 37 rotary heading "machines." Of the longwall machines the "disk" takes the lead, with 656 machines against 152 "revolving bar," and only 37 "chain" machines. Of the total number of machines, 1,136, 451 were worked by electricity and 685 by compressed air, but it is interesting to note that the greater half of the longwall machines were electrically driven, as if the 254 "percussive" machines which can only be worked by "compressed" air be deducted from 685, we have 431 as the number of "air" longwall machines and 451 electric—an excess of 20 of the latter over the former. But though this is no doubt satisfactory, the year 1906 only shows an increase of six electrically-driven machines over the preceding year, whilst compressed-air machines have an increase of 185, due mainly to the introduction of small "percussive" machines for "heading" work, many of which are driven by air, compressed in electrically-driven air-compressors placed underground, and it would appear that if only a satisfactory electrically-driven "percussive" cutter could be placed on the market, it would be quickly taken up.

The Yorkshire and Lincolnshire district takes the lead in both the number of machines and quantity of coal won, with 252 machines and 2,849,134 tons, 95 of the former being electric, while 158 are compressed air. This is explained by the fact that in this district the seams are thicker and more suitable for the "percussive" type of machine. East Scotland district comes next with a total of 176 machines and 1,644,428 tons of coal; and 112 of the machines are electrically driven, whilst the West of Scotland comes next in point of tonnage (1,388,255 tons) with only 129 machines, against Durham, 132 machines for 902,219 tons, and the Midland district with 140 machines for 1,368,349 tons. The next in order are Liverpool and North Wales district, with 107 machines and 712,458 tons; Newcastle district, 87 machines and 609,872 tons; Stafford, 30 machines and 357,605 tons; Manchester and Ireland, 53 machines and 264,805 tons, whilst Cardiff, Swansea and Southern districts have only 30 machines amongst them and a total tonnage of 105,381 tons.

On the whole, there appears to be a great future before coal-cutting machinery, and we have no doubt that electricity will take the lion's share in the development of this important industry.

Prohibiting an Increase of Capital.—An important decision, says the *Electrical World*, has been given by the New York Public Service Commission of the Second District, against a proposed increase of capital. The decision permits a new corporation, the Lockport Light, Heat and Power Co., to purchase the Lockport Gas and Electric Co. and its rival, the Economy Light, Fuel and Power Co., of Lockport. But it forbids the new company to issue securities for a capitalisation above $700,000, equivalent to the total issues of the two old companies. The new company desired to issue stock and bonds to a total of $1,200,000. The decision also makes it plain that increases of the price of gas and electricity will not be permitted to follow the combination of competitive companies. The companies have been engaged in a bitter war in Lockport, as a result of which the prices of energy for lamps and motors in that city are lower than in most cities, and below cost, it is claimed. The combination was planned to put an end to the war.

The commission thinks it quite clear that its policy, in case two or more gas or electric companies in any community are permitted to sell out their property and franchises to one newly formed company, should be to disapprove such sale, unless the total capitalisation of the consolidated or new company, whether stock or bonds, issued in exchange for the securities of the old companies, is kept down so as not to exceed the total capitalisation of the vendor companies.

In taking up the objection raised by the city that the price of electricity would be increased as a result of the deal, the commission points out that this is likely to prove a test case. "A business which supplies to a community a public utility like gas, or electricity for light and power," it says, "is one in which free and full competition between two companies engaged in the same business cannot be expected to prevail permanently. It can doubtless be demonstrated beyond any possibiltiy of successful contradiction that better service and fair prices in the way of furnishing such public utilities to a community can, as a general rule, be given by one corporation than by several, and that this can be done with the use of less capital." Such duplication, it says further, involves public inconvenience in the erection of unnecessary and unsightly pole lines, tearing up of pavements, and so on, and while temporary benefit may result from competition, the usual result is eventual consolidation, poor service, and enhanced prices—the latter "in an effort to make the city and its inhabitants bear the burden involved in paying returns on the unnecessary capital invested in the duplicated plants. The commission accordingly prohibits the increase of prices over those that obtain at present.

A Poplar Contract.—The Electricity Committee of the Borough Council has approved a settlement with Messrs. Bruce Peebles & Co. with regard to a contract entered into by the firm for extensions in 1904. The particulars of the settlement are as follows: To amount of contract, £20,966 10s.; to extras, viz., two armatures, £163 10s.; commutating poles fitted to three converters, £375; rotor for 1,000-kw. generator, £450—total, £21,955. By cash paid on account, £19,477 7s. 6d. Balance, £2,477 12s. 6d. By deductions as follows: Substitution of Allen for Parsons condensing plant, £300; two series regulators, £30. Claims under penalty clause, 1905, £500; 1906, £250; sundries, £86 0s. 7d.—total, £836 0s. 7d. Claim for extra coal consumed, May to August, 1907, due to removal of converter, £187 13s. 1d.; claim for removal of 250-kw. set, from north sub-station to works, £78 3s. 4d.; claim for minor losses, £20 15s. 6d.—total, £1,452 12s. 6d. This sum, subtracted from the balance, £2,477 12s. 6d., left £1,025 to be paid to the contractors. In addition to the deductions already set forth, disallowance of the contractors' claim for repairs to converter at southern sub-station, amounting to £59 10s., has been obtained.

D

ELECTRICALLY-OPERATED PUMPING PLANTS.

By T. L. KOLKIN.

It was early realised that the electrically-operated pump would find a large field in collieries and other mines. It is not necessary here to do more than mention the drawbacks of a steam-operated plant, such as—

1. Long and expensive steam pipes, which have to be continually under steam in order to keep the pump always ready for operation and in order to avoid trouble from elongation due to changes in the temperature.

2. Losses due to condensation ; and

3. Inconvenience caused by the heat radiation from the steam pipes, and the condensed water.

These items have been fully dealt with already on various occasions.

Nor is it necessary to discuss in detail the advantages of an electrically-operated pump, such as that—

1. It receives energy through a cable which requires a minimum of space and attendance, and in which no energy is wasted during the time the pump is standing ; and

2. It is easily stopped and started either from the pump room or from a distant point.

With regard to the type of motor, the first question is whether direct or alternating current should be used. The alternating-current three-phase motor is in most cases undoubtedly more suitable than the D.C. motor for the operation of pumping plants. It requires less attendance, and its design is such that it will more readily stand rough handling, in addition the large motors can be operated on a high-pressure circuit direct, whereby a considerable amount can be saved in cables or transformers. Either slip-ring or squirrel-cage motors are used, and for larger sizes a slip-ring motor with liquid starter turns out cheaper than a squirrel-cage motor with auto-starter.

There may, however, be cases in which it is highly desirable to use a motor without slip-rings, and in such cases, at any rate in connection with turbine pumps, squirrel-cage motors and drum-type auto-starters can be used up to practically any size.

With regard to the pumps themselves, we have two types to consider :—(1) The turbine pump ; and (2) The ram pump.

For large water quantities and comparatively small lifts the turbine pump is undoubtedly superior to the ram pump ; under these conditions the ram pump would assume dimensions out of all proportions.

For heads from 20 to 400 m. or above, both types of pumps are used.

The turbine pump is easier to handle and erect, and requires much less space than the ram pump. This is of greatest importance in the case of an underground installation, where very little space is available and where the cost of excavation, &c., may become a serious item.

The first cost of a turbine pump, including the motor, is also considerably smaller than that of a ram pump and motor of the same capacity. With regard to efficiency, we find that this is smaller for a turbine pump than for the ram pump ; this is particularly the case when direct-driven high-speed pumps are used, and when the head is high. There may, of course, be cases where there is practically no difference as regards efficiency.

It will be easily understood that owing to the nature of the load of a pumping plant, the question of efficiency is generally of greatest importance ; a difference in the efficiency of only 1 per cent. may mean a gain or a loss for each 100 KW. installed of £15 to £20 per annum, according to price of energy and number of hours in service.

I have before me particulars of a large turbine pump which shows what may be expected as regards efficiency.

The pump is a 12-stage turbine pump (six stages on each side of the motor) running at 1,480 R.P.M., and has a capacity of 120 cb. m. per hour, against a head of 430 m. (about 26,670 gallons per hour, against 1,433 ft.).

The two pumps are connected to the motor by means of flexible couplings, and the whole set is mounted on a combined bedplate.

The efficiency of this pump was found during the official tests to be 73·6 per cent.

The motor, which is of 300 H.P., three-phase, 5,000 volts, had an efficiency of 94 per cent. at 93 per cent. power factor.

With regard to the suction lift of the turbine pump, this is as a maximum about 8 m., provided the suction pipe is made satisfactorily tight.

The suction pipe should be provided with a strainer and foot-valve. The strainer prevents stones, pieces of wood, &c., from getting into the pump, and the foot-valve prevents the piping from being emptied during the period of standstill.

In the delivery pipe just above the pump an isolating or regulating valve should be provided. In many cases it is also advisable to put in a non-return valve. This serves the purpose of taking the blow of the falling water in case of sudden breakdown, thus preventing the pump from being damaged.

By means of the regulating valve it is possible to vary the water quantity within certain limits.

As the turbine pump can be started only when filled, it is necessary to provide a special filling pipe bridging over the isolating and non-return valves.

The pump and suction pipe being filled, and all air cocks closed, the motor is gradually started with closed regulating valve. When the motor has reached its full speed, the regulating valve is gradually opened.

We will now turn our attention to the ram pumps. The electro-motor has had a great influence on the design of this type of pump. Whereas ram pumps of 100 to 300 H.P., say, used to be and are still being built for a speed of 40 to, say, 26 R.P.M., high-speed ram pumps are now being built for a speed of about 200 R.P.M. for the smaller, and about 100 R.P.M. for the larger sizes. This enables us to drive the larger size direct, and the smaller size by means of single reduction gear. The great advantage of this arrangement as regards efficiency is, of course, obvious. Whereas the efficiency of a low-speed ram pump, including double gearing, or single gearing and rope drive, is in many cases only slightly better than that of a turbine pump, the efficiency of a direct-driven high-speed ram pump is about 10-13 per cent. higher.

The high-speed ram pump has been used, to a great extent, on the Continent, but, curiously enough, very little in this country, although the results have been very satisfactory.

There is, however, one thing which should be borne in mind in connection with the installation of ram pumps, and that is, that the suction lift decreases with increasing speed,

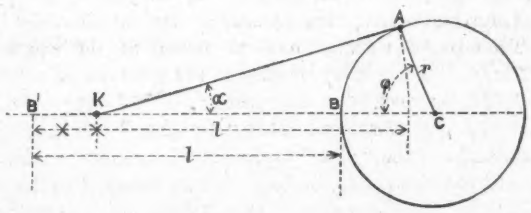


Fig. 1.

all other conditions remaining the same. The reason is that a certain acceleration pressure is required in order to keep the water column in the suction pipe intact.

We will consider any position of the crank, for instance, CA in fig. 1.

During the time the crank travels from B to A the ram covers the distance x, which is determined by the following formula :—

$$x = r\,(1 - \cos\varphi) \pm (1 - \cos\alpha), \text{ whence,}$$

$$x = r\,(1 - \cos\varphi) \pm l\,(1 - \sqrt{1 - (r/l \sin\varphi)^2}.$$

For $l \geq 5\,r$, practically—

$$x = r\,(1 - \cos\varphi) \pm \tfrac{1}{2}\,l\,(r/l \sin\varphi)^2.$$

The speed of the ram is at any time—

$$u = \frac{dx}{dt} = r \sin \phi \frac{d\phi}{dt} \pm \tfrac{1}{2} \frac{r^2}{l} \sin 2\phi \frac{d\phi}{dt}.$$

$d\phi/dt$ is the angular speed, which we will call ω;

thus $u = \omega r (\sin \phi \pm \tfrac{1}{2} r/l \sin 2\phi)$.

The acceleration is—

$$p = du/dt = \omega^2 r (\cos \phi \pm r/l \cos 2\phi)$$
$$= v^2/r (\cos \phi \pm r/l \cos 2\phi),$$

where v is the peripheral speed ($v = \omega r$).

The acceleration pressure $P = m p$, where m is the mass to be accelerated. Thus—

$$P = m v^2/r (\cos \phi \pm r/l \cos 2\phi).$$

The maximum acceleration we have for $\phi = 0$.

$$p_{max} = v^2/r (1 + r/l),$$

and thus—

$$P_{max} = m v^2/r (1 + r/l).$$

For $r/l = 1/5 = \cdot 2$, we have thus—

$$P_{max} = 1{\cdot}2\ m v^2/r$$

where v and r are in metres.

This is the pressure required to keep the water column intact.

Further, if—

h = height of water column in metres required to develop the above acceleration,

S = sectional area of water column to be accelerated in m.²;

L = length of same in metres;

s = sectional area of rams in m.²,

the max. acceleration of the water is

$$p^1_{max} = p_{max}\, s/S,$$

and $$h = 1{\cdot}2 \frac{L\, s\, v^2}{S\, g\, r} = \cdot 122 \frac{L\, s\, v^2}{S\, r}.$$

The water quantity V delivered by a N-throw pump at n revolutions per min. is

$$V = 1{,}000\ N\, r\, s\, n \text{ litres per min.}$$

Thus $$h = \text{const.}\ L\, V\, n/S$$

From the above it will be noticed that, all other things being equal, a high speed, n, requires a large h.

Providing V L and h remain constant, the section S as well as the suction valve must be increased with increasing n.

For one and the same ram section and water delivery the stroke must be decreased with increasing n, while all openings between air-vessel and ram, as well as suction valve, have to be increased, otherwise the suction lift will be reduced.

Large valves have, however, their disadvantages, and the result is that in using high-speed ram pumps, one has to be satisfied with a reduced height of suction.

PREPAYMENT SUPPLY.

By CENTRAL STATION MAN.

Of late years many central station engineers have attempted to cater for the less wealthy classes of population in their area by adopting the system of prepayment supply by means of slot meters and similar devices. In some cases this system is believed to have given satisfaction; in other cases, as evidenced by means of facts and figures given in a paper before the Manchester Section of the Institution of Electrical Engineers, by Mr. J. H. C. Brooking, the systems of rates adopted were not precisely gold mines. Further particulars can be obtained as to the success, or otherwise, of each scheme by reference to this paper.

The writer of the following notes would like to give a few further hints from practical experience. Prepayment is not a method of supply to be lightly undertaken, and once started it must be watched continuously, and this with the greatest care. Accurate returns must be kept, and any interest accruing on capital expenditure must be carefully ascertained. The important points to be guarded are the following:—First, it must be seen that no lights are allowed in rooms that are not continuously in use all the year round. Such rooms as the bathroom, spare bedroom or scullery should never have a light allowed in them on the prepayment supply system. The capital cost of the work should be kept down as much as ever possible by running the wires with the utmost economy, and the cut-outs and meters should be put in at the nearest point of the house to the mains. It must be remembered that prepayment should only be allowed for cottages and artisans' dwellings, and their wishes must be subservient almost entirely to the convenience of the supply authority. This class of people does not seriously object to having the meter, &c., in its front parlour, if necessary, and have no æsthetic scruples concerning casing being run on the ceilings. This considerably simplifies the question as to where to bring the service into the house, and how to distribute the lights.

The supply authority should do everything possible to induce tenants to keep on using the light: there is a tendency among the class considered, after the first few months, during which time the novelty of the system gets worn off, to revert to oil or candles. If the lamps get worn or broken, the easiest course appears to these people to be that of giving up using the light. For this reason, if no other, constant and vigilent supervision of the actual state of the lamps on the prepayment system is necessary. Every quarter when the meters are read, it is advisable to send a responsible man to the slot consumers above all others, with instructions to ask everyone of these tenants if he is satisfied. Where they want new lamps, where the wires and fittings are in poor condition, and if it is found that they are using no current or are using less than they used to do previously, the reason must be ascertained exhaustively.

Some few years ago the writer took over a supply system which had about 300 small prepayment consumers, who had been neglected and allowed to lapse back to candles. By a system of personal calls, giving new lamps, altering lights and putting meters in good order, he raised the revenue from these 300 consumers by 30 per cent., with a capital expenditure of only £20. This increased output has been maintained ever since. The writer is able to give the average cost of wiring some 500 cottages, each containing seven to ten lights, the figures being taken from several towns in various parts of England. Summarised and averaged the figures are as follows:—

Average cost of wiring per house	£7 10s.
Average cost of meter and service	£4 8s.

It will, therefore, be seen that the capital cost of prepayment meter installations is considerably high and inflicts a heavy first cost on prepayment schemes. Prepayment supply should not be given at a lower price than 7d. per unit, because against the receipts three items have to be reckoned, the first being depreciation on installations which cannot be safely put at anything less than 3½ per cent., interest on capital must be taken at 5 per cent. and the cost of meter readings, doing the slight repairs, putting in new lamps, &c., at 2 per cent. Another way of looking at these figures is to allocate the 7d. per unit as follows:—

To sale of current which goes towards revenue ...	3½d.
To interest on capital required per meter	2d.
To interest on service and mains	1½d.
To interest on free lamp renewals	½d.

3½d. per unit, while not being in the majority of supply systems an unfair price for the lighting load, is not altogether a very flourishing revenue, when against it has to be placed the normal expenses of generation and distribution and the standing charges of the concern.

The following table of the capital cost and the balance to revenue of 24 prepayment cottages in the poorest district of a town of some 300 slot consumers is of interest:—

Capital cost of installation including meter.	Deduction to pay 4½ per cent. on capital cost of installation.	No. of units consumed.	Total cost of units at 1·70d.	Annual gross revenue.	To be deducted from revenue columns.	Balance.
£316 8 0	£23 14 4	1,410	£9 18 2	£35 4 0	£33 12 6	£1 11 6

It will be seen that on the capital of, roughly, £316, the balance of clear profit is only £1 11s. 6d., after paying all reasonable expenses, and this does not represent a very paying load for concerns which seek either to relieve the rates or pay shareholders' dividends.

An interesting point arises in this connection, which is that small shops may be more profitably taken on prepayment rates than cottages. From a number of actual results in the possession of the writer, if 7½ per cent. on the revenue is allocated to capital, an average price of 3·69d. per unit is obtained with this class of slot consumers, whereas with cottages on the same allocation an average price of 1·91d. only is obtained. This makes all the difference between the success or failure of the scheme in paying for revenue charges. The average price per unit, assuming an equal number of shops and cottages are connected, is 2·8d., and assuming that the total cost per unit generated and distributed is 2·25d., which is a low average for the usual run of supply undertakings, it will be seen that the difference does not leave enough margin to enable anyone to say that electricity supply on a prepayment basis is actually a paying thing.

On the whole, therefore, it seems that where the manager of a supply undertaking can in any way do without it—that is to say, unless he is faced by the problem of having to supply small cottages and shops on a prepayment basis or run the risk of having his undertaking regarded as a ridiculous luxury in the district in which he operates—it is better to avoid prepayment schemes altogether, and fix his attention on the better class of consumers, which, although perhaps numerically small, constitutes a very favourable load.

Where it is absolutely necessary to take up the slot meter system for reasons quite apart from such as those just alluded to, the energy of the manager should first of all be directed to getting a large proportion of small shops to take up the consumption of electricity on this basis, inasmuch as the private house load of the smallest class can then, to a certain extent, be upheld by the payments from the shops.

ELECTRO-METALLURGICAL OPERATIONS.

[COMMUNICATED.]

No branch of applied science has had more far-reaching effects or has made more rapid and wonderful progress than applied electro-chemistry. Within the last 10 or 15 years achievement after achievement has been announced, and the resulting industrial success has been extraordinary. This is true not only of a few isolated branches of industry, but also of almost every case where electrical methods have been applied as an aid in the production of commercial substances. One example is sufficient to illustrate this statement. Fifteen years ago aluminium was regarded almost as a chemical curiosity. Its low density gave it in the eyes of the general public something of the supernatural, and its high price placed it out of the category of useful metals. At that time not more than a few hundreds of tons were manufactured annually, while to-day several thousands of tons are being produced. This marvellous progress is due entirely to the application of electrolytic methods to the aluminium industry.

The manufacture of this metal commenced not quite 20 years ago, the method being worked out independently by Héroult and Hall. This consists of the electrolysis of alumina in a bath of fused fluorides. The electrodes used are made of carbon. In this process careful regulation of the voltage is necessary to prevent the decomposition of the electrolyte, but otherwise the working details are not difficult to overcome. The main difficulty lies in the purification of the mineral deposits of alumina, which is necessary for successful work. The right to produce this metal is now public property, but the use of electric heating is still covered in America by the Bradley patent until 1909. At the present date this branch of industry is in the very enviable position of being unable to supply the demand, and as a consequence high prices rule the market. Thus two years ago the price of aluminium was £120 per ton, whereas at the commencement of the present year it had risen to £200 per ton. To meet the ever increasing demand, and to prevent further competition, the companies now engaged in this trade are making huge developments in every direction. Thus the British Aluminium Co. has in course of construction two new works, one near Loch Leven and one in Switzerland, which, when completed, will increase their total available power to 70,000. At the same time the share capital is to be increased to £1,300,000. By this means the total output will be increased many times, and as a consequence a fall in the price is to be anticipated. It is not to be expected, however, that in a fertile field like this attempts will not be made to start other companies. At the present moment there is a new scheme in hand in Wales for the production of aluminium, the capital being £60,000. A similar activity prevails in America, where the Pittsburg Reduction Co. has a monopoly due to the holding of the Bradley patent rights. In two years the latter will become public property, and this explains the haste of the American company to ensure its rule of the home market. Similar to this expansion is that now being put in progress by the German and Italian companies, which hope in the near future to more than double their output.

The wonderful advance now being made in the aluminium industry is by no means exceptional. Another notable example is to be found in the production of ferro-alloys. This industry is much younger than the previous one, but promises to become no less important. Progress here is of the same rapid nature as with the aluminium industry. Thus in France, P. Girod commenced his experiments a few years ago with a 28-H.P. plant, which at the present time is being increased to 45,000 H.P. The yearly output of the firm at present is over 10,000 tons of metal, valued at £500,000. In America the Wilson Aluminium Co. is producing large quantities of ferro-chrome alloys and occasionally quantities of ferro-silicon. From the success of these two pioneer companies, it is not to be wondered that others are entering this fruitful field.

The two processes mentioned above may be regarded as types of the present day large scale industries using electricity as a producer. The first consists of the electrolysis of a fused salt, and similar processes are in use for the preparation of other metals. Thus sodium, magnesium and calcium are all deposited from fused salts, and the field is likely to be extended in the near future. The production of the alloy in the second class is due to the thermal effect of the current, the metal being reduced by means of added carbon. The second type of process is used far more extensively than the former. In this manner many thousands of tons of steel are now produced annually by the three successful furnaces in use—Héroult, Kjellin and Keller. Phosphorus, carborundum, emery, graphite, and many other products are manufactured by similar processes.

There is still another large branch of the electro-chemical industry which is enjoying a similar prosperity to that of those mentioned above. This deals with the electrolysis of aqueous solutions of salts, and may be divided into two great classes: Refining of metals, and products of anodic and cathodic reactions. For the refining of metals the greatest success has been achieved with copper. This industry commenced 40 years ago, and is by far the oldest of all these processes. From a very modest beginning, progress has followed with leaps and bounds, and at the present day more than half the world's output is refined electrolytically. The process is simple, and consists essentially of electrolysing raw copper in a copper sulphate solution, to which various chemicals are added to ensure a smooth deposit. Not only is pure copper obtained, but silver and gold are also extracted from the anode sludges. This process has been put to many other uses beyond the bare production of pure metal, By using rapidly rotating drums, seamless cylinders are manufactured for various uses. Narrow copper tubes for motor-cars are made by an impinging process, and many other products are made by similar modifications. Analogous to this is the electrolytic refining of lead and bullion, cold galvanising, and others. The most recent attempt in this direction is the production of iron by electrolysis of the

sulphate. At the present time this is still in an experimental stage, but some amount of success has been achieved in the formation of case-hardened steel plates.

The chief application of anodic and cathodic reactions is to be found in the production of bleach liquors, chlorates and caustic alkalies. For this purpose approximately 70,000 H.P. is being used, and large extensions are now in progress. In this direction alone the ingenuity displayed by inventors merits the admiration of the whole of the civilised world. In the case of bleach liquors and chlorates, no special difficulty is encountered. A solution of common salt is electrolysed and the products of the anode and cathode are allowed to mix. When caustic alkali is to be produced, these two constituents must be separated, and it is here that special appliances are brought into use. Other anodic and cathodic reactions are used, on a smaller scale, chiefly in the refined chemical trade of the Continent.

From these main divisions innumerable smaller branches have sprung up, both directly and indirectly connected with the industry. Of not the least importance of them is electro-analysis, which is now being introduced in many works. The Muntz Metal Co. adopted such a procedure long ago, with the result that a perfect check has been put upon the nature of their alloy. The fixation of nitrogen from the air, either as a side issue of the carbide industry or from the direct combination of the elements of the atmosphere, has been made possible by the application of electro-chemical methods. It is stated also that alcohol is being produced in France from a metallic carbide, but as yet these industries are too young to furnish reliable details.

From this brief outline it will be seen that there is a brilliant future for electro-chemistry, and this is especially the case where cheap power is to be had. For this reason, such countries as Norway and Sweden, which have hitherto exported large quantities of minerals, will use more and more of their raw products as their water supplies are developed. It is not to be expected, however, that older processes, depending on fuel, will be replaced, but it will make the utilisation of cheaper forms of fuel desirable. In many cases the old and the new *régime* will work hand-in-hand, as in the case of steel production. It is most economical to produce pig-iron in the blast furnace at the present day, but the surplus furnace gas will probably be used for producing cheap electrical power for the final refining of the steel. In many other industries it is possible that a similar combination will result from the introduction of these newer methods. Thus, for lead reduction A. Betts has already devised a method of combined electrolysis and preliminary refining by the method at present in use. In another direction many developments are to be expected, depending on the use of different cathode materials, and it is very probable that in the near future the price of many pure chemicals will be considerably cheapened. Electro-chemistry as an industry is both far-reaching and progressive. Its importance is fully recognised in America and on the Continent, and it is highly desirable that greater interest should be awakened in this country also.

CORRESPONDENCE.

Letters received by us after **5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Suggestion Box.

In answer to the last article about the suggestion box, I should like to say the following :—

As "Suggestion Box" pointed out, it would be a most useful thing for it to be adopted and worked properly. I have been with several firms where the suggestion box was adopted, but not worked properly, and I have also been in two places where it worked very satisfactorily.

Satisfactory results can be obtained if the directors have a monthly meeting to open the letters found in the suggestion box, and to prove the merits of each suggestion. Should any suggestion be found worth adopting, the man who put forward the suggestion should be awarded a certain sum. His name should be kept strictly private by the directors. Then the chief draughtsman or chief engineer should be called in, and he should investigate the suggestion from his point of view. In every case there will be objections to any new thing brought forward, and as the man who made the suggestion will only have made it looking at it from a one-sided standpoint, the chief draughtsman must appreciate the danger which every new arrangement might mean, notwithstanding its merits; certainly his opinion is of the greatest value. Should the directors of the company, after consultation with the chief draughtsman, still think it wise to adopt it, then they should issue instructions to the chief draughtsman to make the necessary arrangements accordingly. The name of the man who made the suggestion is, of course, as mentioned above, only known to the directors.

The reason why in many firms the suggestion box is put in for the workmen only is, I think, hard to find. Perhaps it is anticipated that the draughtsmen can make their suggestions verbally. Anyhow, after my experience, it should be open to everyone employed by the company, and then, I think, the firm who starts the suggestion box should work on the lines described above.

I mentioned that I worked with firms where the suggestion box did not work satisfactorily. The reason was this. The managers saw the merits of the suggestion, and without consulting the chief draughtsman about his possible objections, simply ordered him to put the new idea through. This is a very wrong way, because as most readers of this letter will know, out of a hundred suggestions there will be seldom more than one really good one, and that is a reason why many firms also grow tired of the suggestion box, and give it up after a short trial.

Chief Draughtsman.

City and Guilds Exams.

May I draw the attention of those of your readers who intend sitting at the next examination of the City and Guilds of London Institute in Electrical Engineering, to the new regulations which are now in force? Previously anybody could sit for the examination, provided he had paid his fee; now, however, new regulations have been issued, which, I think, are not generally known. The most important of these regulations is that *all* candidates, irrespective of grade, must have attended a *recognised course* of electrical engineering (lecture and laboratory work), and must present a certificate stating that they have attended satisfactorily such a course. Students should therefore ascertain whether the course they are taking is a recognised one, and also that their teacher is a *recognised teacher*. A list of recognised teachers is usually to be found in the programme of the City and Guilds of London examinations, issued by Mr. John Murray.

Nemo.

Binnacle Lamp for Yacht.

Would some of your readers help an ignoramus in a simple matter, but one on which he cannot get information?

What is wanted is a small glow lamp to work from Leclanché cells, giving, if possible, light for some hours at a time. The lamp could be very small, being for a yacht's binnacle, whose oil lamp is not always reliable in much wind.

Some twelve years ago I arranged for an invalid friend a 3-volt glow lamp with four Leclanché cells, stranded flexible wire, and bell-push. This still does very well with the usual attention. My next trial was with a lamp having a dry battery, much of the "Ever-ready" type. This bulb I tried with two Leclanché cells, to see how long it would burn; it was over an hour before it got distinctly red. But on trying the same bulb with four freshly-charged Leclanché cells, there was one bright flash and then darkness. This last, unlike the former trials, was on solid, not stranded, wire.

What would be the best arrangement of this kind, using Leclanché cells?

Apart from this, can small dynamos working by friction on fly-wheel be obtained here? I have seen them abroad, in boats not over 30 ft., doing all the lighting, and very possibly the sparking as well.

My auxiliary paraffin motor runs about 400 R.P.M.; fly-wheel about 2 ft. diameter; tube and magneto ignition.

Ignoramus.

Fault Finding, or Gone to Earth. Tally ho!

With reference to this interesting article which appears in your issue of the 22nd inst. under the above heading, it would be very useful if the author would deal with trouble or faults in underground mains in a similar manner to that in which diseases are sometimes described in medical literature—viz., Symptoms, Causes and Remedy; that is, giving particulars under these headings, and, in parallel columns, the methods which have been found, and proved by experience, to be useful.

O. H. M. S.

Looping-in v. Joint Box.

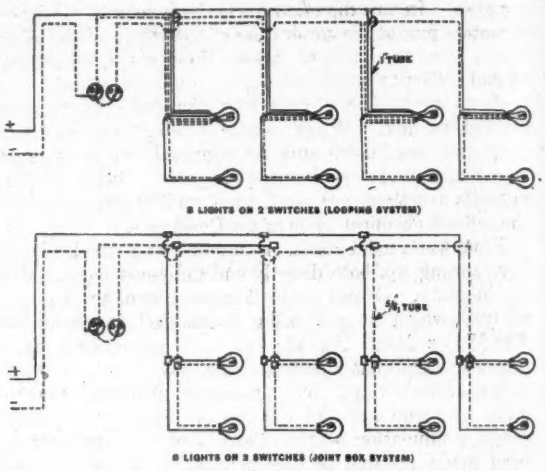
I think no apology is needed for bringing forward again the important question of cost and system of wiring for electric light.

The system now favoured by consulting engineers, insurance companies and other authorities is the looping-in system, and this with heavy gauge screwed conduit is generally accepted as the standard method for all first-class work. In the system of parallel wiring a certain number of joints were necessary, and it was to avoid these joints that the looping-in system was introduced. It is true that the soldered joint is eliminated, but at what a price! In the first place, it is a fallacy to speak of the looping-in system as a jointless system. There are really more joints than ever, and they are made in the worst possible places, being crowded together in the small lamp socket terminals. I venture to say there are more failures from this cause than were ever due to the joints on the older system. It is the custom to specify that no wire less than 3/20 shall be used, and this wire heavily insulated. Accordingly 4, 5 or 6 such wires have to be crowded into a socket where there is barely room for two. The incoming and outgoing wires for each pole are twisted together, and as much as will go in pushed into the terminals and fixed by means of a small screw. I fail to see how this is in any sense an improvement on the whole system of soldered and insulated joints, always provided that these are made in accessible positions. The increase in cost, however, is very great, as not only more wire, but larger tubing has to be used; in fact, the only people who benefit by the system are the cable and tube makers (perhaps this accounts for their comparative prosperity).

Many unfortunate wiring contractors have gone down through taking on large contracts without realising the enormous quantity of material required to carry work out on this system.

As an alternative to what, I submit, is an expensive and inefficient system, I will now describe one which, in my opinion, is superior, and is unquestionably much cheaper. I do not claim it as a novelty, although I do not know of any important installation carried out in this way. Briefly, the proposed system is to use at each point where the ordinary looping would commence, a joint box fitted with loose porcelain interior. Terminals are provided of substantial size attached to the porcelain, and the line wires and branches are connected at these points. The joint box should preferably have an insulated lining, or may be filled up with bitumen like an ordinary underground box. The box itself is not an extra. The porcelain, mounted with terminals, is extra, but is a small item compared with the saving of wire, tubing and labour. The Simplex Co.'s list shows boxes and interiors suitable for the purpose, except that it should not be necessary to cut the wires, but only to bare the conductor and slip it into a slotted terminal, the branch wires could go into the same terminals so that only two screws would be required in each box.

In ordinary house wiring the waste of material is not of so much consequence, as the runs are short, and smaller wires are used. The objection to the crowded socket remains.



The diagrams show a circuit of eight lights on two switches wired on the two systems. The fittings are supposed to be tube pendants with the looping carried down the tubes. Of course if the looping is to ceiling roses only, it is not so bad, as there is more room for the wires, but the waste of wire, tube and labour remains.

I think the subject is well worth consideration, and hope that these few remarks may draw attention to it again.

J. O. Girdlestone.

Willesden, *November 26th*, 1907.

Shock from Tramcar.

The experience your correspondent, Mr. G. Moss, describes in your issue of the 29th ult. was decidedly an unpleasant, if not a dangerous, one. Insulating the hand rail and step would certainly prevent a shock of this nature, and I think the former should be insulated in all cases. As to the step, however, there would be no possibility of accident from this cause if the cheap device, recently patented, were adopted universally, *i.e.*, an "interlocking safety step," by which the motorman cannot start his car whilst there is anyone on the step, boarding or alighting. The arrangement is electrical and is practically infallible.

Safety.

Denton, *December 2nd*, 1907.

Aluminium v. Copper for Cables.

When reading the exceedingly interesting article on "Aluminium as a Substitute for Copper for Electrical Transmission Purposes," by Mr. John B. Sparks, in your issues of November 15th and 22nd, it occurred to me that the curves giving the relative prices of copper and aluminium necessary for equal total costs of copper and aluminium cables might be directly deduced from the curves of cost of insulation, labour, &c., and the other data in the first part of the article, without the necessity of constructing Tables I and II. Moreover, as will be seen, this direct method possesses the further advantage of giving a result which is absolutely general, being equally applicable to high or low tension, lead-covered or taped and braided cables, or to the bare conductors used in overhead transmission lines.

Except in the case of extremely high voltages, the curves given by the author for cost of insulation, labour, &c., are straight lines. In these curves the cost is plotted as a function of the sectional area of the conductor, so that—

$$P = a + b s,$$

where P denotes cost of insulation, labour, &c., s the sectional area of conductor in sq. mm., and a and b are constants.

Let k denote ratio of section of an aluminium core to that of a copper core of equal conductivity. This constant is given by the author as 1·64.

Let w = ratio of wt. in tons of 1 kilometre of copper core to its cross-section = $10^6 \times 8{\cdot}9 \times 10^{-3} \times 10^{-6} = 8{\cdot}9 \times 10^{-3}$, where 8·9 is the sp. gr. of copper.

And w' = ratio of wt. in tons of 1 kilometre of aluminium core to its cross-section = $10^6 \times 2{\cdot}7 \times 10^{-3} \times 10^{-6} = 2{\cdot}7 \times 10^{-3}$, 2·7 being the sp. gr. of aluminium.

Also let p_c = price per ton of copper wire, and p_a = price per ton of aluminium wire.

Then, reckoning costs for 1 kilometre of cables of equal conductivity—

Cost of copper core = $p_c\, w\, s$.	Cost of aluminium core = $p_a\, w'\, k\, s$.
Cost of insulation, labour, &c., for copper cable = $a + b\, s$.	Cost of insulation, labour, &c., for aluminium cable = $a + b\, k\, s$.

Therefore, for equal total costs of the two cables—

$$p_c\, w\, s + a + b\, s = p_a\, w'\, k\, s + a + b\, k\, s.$$

The constant a evidently disappears, so that—

$$p_c\, w\, s + b\, s = p_a\, w'\, k\, s + b\, k\, s.$$

Dividing through by s—

$$p_c\, w + b = p_a\, w' k + b\, k.$$

This shows, as was pointed out by the author, that the relative prices of copper and aluminium necessary for equal total costs of cables of equal conductivity, are independent of the section of core used.

$$\text{Finally,} \quad p_c = \frac{w'}{w}\, k\, p_a + \frac{b}{w}\,(k - 1)$$
$$= \tfrac{1}{2}\, p_a + 72\, b$$

on substituting the values of k, w and w'. The only constant to be determined is b, which represents *the rate of increase of cost of insulation, labour, &c., with the section of core.* This constant will, of course, be greater for high than for low voltages, so that the difference between the costs of aluminium and copper cables is greater for high than for low-tension cables, which the author pointed out would be the case.

Substituting in the above equation the values of b for the curves in figs. 1 and 3, it will be found that the three equations thus obtained are those of the curves of figs. 2 and 4.

Thus, for 660 volts, single-core cables $p_c = \tfrac{1}{2}\, p_a + 27$,

for 5,000 volts, three-core cables $p_c = \tfrac{1}{2}\, p_a + 43$,

and for 10,000 volts, three-core cables $p_c = \tfrac{1}{2}\, p_a + 70$.

It should be noticed that in the case of high-tension cables, the insulation, labour, &c., curves are given for *three-core cables*, the cost of insulation of the *whole* cable being plotted as a function of the section of *one* core, and account must be taken of this in substituting the value of b. In fig. 4 the 5,000-volt curve has evidently been plotted for cores of sector section, and the 10,000-volt curve for circular section cores. Since, however, the curves in fig. 3 for sector section cores are all parallel, from that for 5,000 volts up to that for 20,000 volts, the value of b is the same for them all, and the constant term in the equation deduced above is the same for all voltages from 5,000 to 20,000 volts. The 5,000-volt curve given by the author in fig. 4 is, therefore, true for all voltages from 5,000 to 20,000 volts, *provided cores of sector-shaped section are used.* The two curves of fig. 3 for circular-section cores being also practically parallel, the curve for 10,000-volt circular-section cables in fig. 4 will also be true for cables of circular cores up to 20,000 volts.

In the case of overhead transmission, the author gives curves for cost of towers, insulators and erection (excluding cost of conductors) for both copper and aluminium lines (six conductors), which curves, being also practically straight lines, may be treated in exactly the same manner as shown above. These curves are, however, different for copper and aluminium.

Denoting the cost of copper line (excluding the conductors) by $P_c = A + B\, s$, and that of the aluminium line by $P_a = A' + B'\, s$, we get, for equal *total* costs of line—

$$6\, p_c\, w\, s + P_c = 6\, p_a\, w'\, k\, s + P_a,$$

$$\therefore 6\, p_c\, w\, s + A + B\, s = 6\, p_a\, w'\, k\, s + A' + B'\, k\, s;$$

$$\therefore p_c = \frac{w'}{w}\, k\, p_a + \frac{(A - A)}{6\, w\, s} + \frac{(B'\, k - B)}{6\, w}.$$

It will be seen, on referring to fig. 5, that both B′ and B are constant for all voltages, and are equal respectively to 0·7 and 1·6. Also, since all the curves for copper intersect corresponding curves for aluminium on the same ordinate, the term $(A' - A)$ is constant and equal to about 45—

$$\therefore p_c = \tfrac{1}{2}\, p_a + \frac{45}{6\, w\, s} - \frac{0{\cdot}45}{6\, w},$$

$$= \tfrac{1}{2}\, p_a + 8{\cdot}4 \left(\frac{100}{s} - 1\right).$$

Suppose now that the prices of aluminium and copper are such that the cost of the bare conductors is the same, *i.e.*, $p_c = \tfrac{1}{2}\, p_a$. Then the total cost of an aluminium line will be *greater* or *less* than that of a copper line according as s is *less* or *greater* than 100 sq. mm. For sections greater than 100 sq. mm., an aluminium line may be as cheap as, or cheaper than, a copper line, even though the price of copper is less than half that of aluminium, since the term $8{\cdot}4 \left(\frac{100}{s} - 1\right)$ is negative for values of s greater than 100 sq. mm.

E. A. Biedermann.

Thornton Heath, *December 2nd*, 1907.

Breakage of Lamps in Transit.

I should like to hear the experience of others, and what course they pursue with regard to "Osram" lamps broken "in transit" (?!)

A few weeks ago I had occasion to send a sample order for 32.

On receipt of these, though they had been most carefully packed, no fewer than 11 were found defective. As an extra precaution, they were sent at "Railway Co.'s risk." To the latter, naturally, we sent our claim.

Their reply, however, was that they could not hold themselves responsible, and that we must look to the sender for replacement. I understand that the manufacturers and agents of these lamps only allow 3 per cent. for broken lamps—our lot amounts to close on 35 per cent.

One certainly would not blame the railway company for not being responsible for ordinary risks, as, of course, they have no means whatever of assuring themselves that the goods were non-defective when consigned, but I maintain that if they accept the extra amount paid on freightage for "At Co.'s risk," that is tantamount to their issuing an insurance policy on the safe arrival of the goods, in which case surely the railway company is liable.

Chas. E. Gray,
Resident Engineer.

Ross Electricity Works,
November 30th, 1907.

Wireless Telegraphy.

Seeing in your issue of this week an idea illustrating how to receive wireless waves, and being interested in such things, I read the article, and find it is an example of two minds thinking the same thing out. I find in my notebook of the date December 28th, 1905, a similar idea of my own. By passing a coil around a magnet, the same as a motor, one end being connected to the aerial wire and the other to earth, the impulses would be the same in an armature rotating in that field, but very weak; my idea was to pass the current

through the field of a second motor, and the armature would take up the same wave frequency; if found strong enough, I propose working a relay from this, if not, a third motor similarly connected may be used, the motors to be on one shaft, and, of course, driven at the same speed. I have not had time or capital to prove the idea, but in my opinion it is good; my reason in writing is just to show this is one of those things people call coincidence, and being a reader of the REVIEW, I thought possibly you would like to know the idea was thought of before. I see you say the idea is one that may be of good service; that was my opinion at the time.

J. T. Butler.

Manchester, *November 29th*, 1907.

SMALL-CURRENT ARCS.—Wanted names of makers of 1-ampere arc lamps for D.C. or A.C. circuits.—H.

THE CITY LIGHTING.

BY HAYDN HARRISON.

THOSE who have had an opportunity of passing through the streets of the City of London at almost any time during the last few weeks will realise that they present an object lesson in street illumination. But as the human eye, unaided by a photometer, is liable to be considerably misled when judging such matters, I have made a series of tests to ascertain the value of the results obtained by the various means adopted.

These results are particularly interesting, as they depend not only on the lamps used, but also on the method of their installation. In fact, the lamps themselves in two instances —namely, Cannon Street and Holborn—being of the converging flame carbon type, are on the same general principle though of different make; yet the fact that they are installed differently, and provided with differently shaped globes, considerably modifies the results obtained.

In accordance with the principles I advocate—namely, the measurement of direct, or nearly direct, illumination, and the calculation from that of candle-power, or horizontal illumination if desired, these tests were carried out, the instrument used being Elliott Bros.' Universal Flicker Photometer, which has already been described in this journal. I arranged that tests should be made simultaneously with a horizontal screen photometer of Everett, Edgcumbe & Co.'s latest pattern; but the results obtained with this instrument (due probably to the difficulty found in obtaining a balance at high degrees of illumination of different spectrums, and to the errors introduced by the acute angle of incidence of the light) diverged so considerably from the actual results obtained by measuring the candle-power, distance and the angle of incidence, that I have not included them in this article.

The measurements were all taken at 4 ft. from the ground, and the streets tested were:—

CANNON STREET.—Oliver and Gilbert long-burning flame arc lamps, suspended over middle of street; 28 ft. high. Forty-six to the mile.

HOLBORN VIADUCT.—Oliver long-burning flame arc lamps, erected on alternate sides; 23 ft. high. Forty to the mile.

QUEEN VICTORIA STREET.—Two mantles, high-pressure gas lamps, on alternate sides; 13 ft. high. Seventy to the mile.

FARRINGDON STREET.—Enclosed arc lamps on alternate sides; 17 ft. high. Seventy-two to the mile.

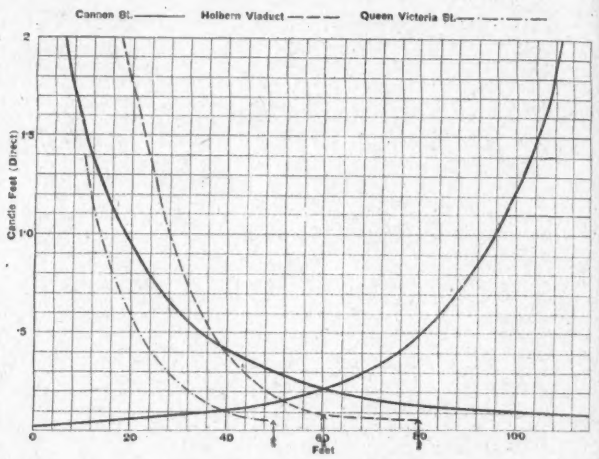
The actual number of lamps per mile is calculated by measuring the distance apart of those tested, and thus computing it. The width of the streets varied from 50 to 60 ft. between the kerbs, with the exception of Farringdon Street, which is wider in several places.

The mean of the actual results obtained is shown in the curve, the candle-feet (direct illumination) being the ordinates, and the distances measured from a point directly below the lamp being the abscissæ.

The full-line curve represents the results obtained in Cannon Street. It will be noticed that two of these are shown, there being two different types of lamps with different globes, which slightly vary the character of the curve.

The plain dotted line gives the results obtained in Holborn, and distinctly shows the variation due to the acorn-shaped globe used, and the reduced height of the lamps.

The other curve represents Queen Victoria Street lighted by gas lamps. The arrow heads at the bottom of



ILLUMINATION CURVES IN THE CITY.

the curves show the points half-way between two adjacent lamps, which are approximately the points of minimum illumination.

The results obtained in Farringdon Street are not plotted, as, owing to the low illumination, comparatively few measurements could be made.

From these curves it will be seen at a glance that the lighting of Cannon Street is the best, as the minimum direct illumination half-way between the lamps exceeds 0·2 candle-feet; whereas in Holborn it is as low as 0·06 candle-feet, and in Queen Victoria Street 0·1 candle-feet. In Farringdon Street it falls as low as 0·04 candle-feet. The minimum horizontal illumination is as follows:—Cannon Street, 0·16; Holborn, 0·030; Queen Victoria Street, 0·033; Farringdon Street, 0·010.

The low minimum illumination in Holborn is, to a large extent, due to the low candle-power of the two lamps at the rays approaching the horizontal, which is accentuated by the lamps not being erected as high as those in Cannon Street. For instance, the measured candle-power 10 ft. from the post is 1,600, against 400 at 50 ft. from the post; whereas in Cannon Street the difference is comparatively small. The result of this bad distribution is not only to reduce the minimum illumination, but also to increase the maximum, as will be seen from the fact that at a distance of 18 ft., in the case of Holborn, the illumination exceeds 2 candle-feet, whereas in Cannon Street it is only 1·1.

As I have been able to give the approximate number of lamps per mile, it will be readily seen that the excellent illumination in Cannon Street is obtained without any appreciable increase of cost, and is due to the correct arrangement of the lamps; which arrangement not only conduces to the comfort of the public by the better lighting obtained, but also by withdrawing from their line of sight the powerful lamps necessary for the purpose.

Copper.—Advices from London, says the *Electrical World*, state that a pool, in which the largest copper consumers of Europe are represented, was recently formed in that city, and has purchased 50,000 tons of copper. The price paid is slightly above the prevailing price in the market. The copper is to be delivered in November and December. The amount involved is approximately $15,000,000, which is to be paid in London on delivery.

LEGAL.

W. Bakewell *v.* Shaw & Sons.

At the Leeds Assize Court on November 27th, this case was heard, in which plaintiff, an electrical engineer, of Sheffield, sued defendants, claiming £257 odd for work done in connection with an electrical installation at the Holmes Pottery, Rotherham. Defendants said that the work was not carried out to the specifications, and they entered a counterclaim for £224 10s., the sum incurred in making the work comply with the terms of the contract. From a report appearing in the *Sheffield Daily Independent*, it appears that one of the chief points in dispute was whether Association grade cables meant Association made cables, or whether they had merely to be of the quality of those made by the associated firms. Another problem was the correct interpretation to be placed upon the words "coupling up." Owing to defendants desiring an alteration in the position of the switchboard, 160 yd. of insulated wire were necessary for the work of coupling up, and plaintiff's contention was that the cost of this wire should be borne by the defendants. On the other hand, the defendants argued that it was covered by the terms of the contract.

Mr. Shaw (one of the defendants), who was under examination and cross-examination two and a half hours, stated that the work would not pass the insurance company's test.

It is stated that at one point in the course of the hearing the Judge (Mr. Justice Channell) testily exclaimed, "I wish I had known what this case was about before I began it, because it is quite clear that it ought to have been decided by an electrical engineer, and not by me."

Subsequently he intimated that he had come definitely to the conclusion that the plaintiff did not, in fact, tender for the 160 yd. of insulated wire necessary for the coupling up with the dynamos; "and, I may further point out," he said, "that in my view, under the circumstances, the plaintiff must get the value of his work." He suggested that the parties should arrive at a conclusion, and again expressed regret that he did not know what the case meant when he started on it, because he would certainly have referred it to an electrical engineer at once. "But I can't do so now," he pointed out.

Counsel and clients accordingly conferred at considerable length, and eventually Mr. Waugh announced to his Lordship that the parties had come to terms which, he thought, need not be publicly stated.

The Judge made an order for the payment to the plaintiff of the money paid into Court, and remarked he was exceedingly glad that the parties had come to an arrangement, because he had come to the conclusion that it was a misunderstanding between them. One party understood the contract in a different way from that in which the other party quite honestly understood it, and he (the Judge) would have had to decide as to the legal construction, which would not have been satisfactory to either of the parties.

Henley *v.* Heath: Alleged Defective Wiring Work.

At the Brompton County Court on November 28th, before his Honour Judge Selfe, Mr. G. Henley, of 57, Oxberry Avenue, Fulham, sued Mr. Heath, builder, of South Eaton Place, for £30 11s. 8d. for work done, and there was a counterclaim for £91 10s. 3d. Mr. Warren appeared for the plaintiff, Mr. Ball for the defendant, and Mr. Oliver for Mr. Dewhurst, who was a third party to the action. It transpired, from counsel's statement, that there was no dispute as to the plaintiff's claim for £30 11s. 8d., which was for work done which had no connection with the counterclaim.

Mr. Warren first asked for judgment for the amount claimed, £30 11s. 8d., and this not being contested, judgment was given.

Mr. Ball then opened the case for the defendant on the counterclaim, and said the defendant claimed to be entitled to recover from the plaintiff the sum of £91 10s. 3d., which was the amount expended in making good the alleged bad work of the plaintiff at Euston Hall, Suffolk. Mr. Heath, the defendant, was a builder, and in 1905 was under contract to do certain building work at Euston Hall, the country seat of the Duke of Grafton. Part of that work was the provision of electric bells in the rebuilt portion of the mansion—the older building having been burned down. Not being an electrical expert, he employed the plaintiff, Henley, to put in these bells. A man named Dewhurst, in plaintiff's employ, interviewed the defendant, and, having examined the plans and heard what work was required, gave an estimate. Plaintiff had full opportunity of seeing what work it was he had to undertake, and on August 10th, 1905, he agreed to contract to do the work for £28. On August 10th the defendant wrote to Henley "Please put in hand the electrical bell work for the sum of £28, only the best materials to be used; specification enclosed; work to be done immediately." The specification, which counsel produced, set out the work required to be done. In pursuance of that contract, Dewhurst was sent down to Euston Hall, and with the assistance of two lads carried out the work. In the course of the work it was decided to wire the old part of the building; a second estimate was procured, and Henley agreed to do the work for £30. Certain other work was ordered verbally, and the eventual cost was £61 8s. Payments for the work were made from time to time, and, in fact, it had all been paid for. The electrical work was completed in December, 1905, but Heath's people were on the premises until July, 1906. Up to that time the mansion had not been inhabited by the owner, but in July, 1906, the Duke of Grafton took up his residence, and then it was found that the bell installation would not work at all. There were numerous faults—bells would not ring, some of the bell pushes would not make the bells ring, and in other cases when pressed in they would not come out again; and on inspection it was found that the batteries put in were completely run down, although they had been little used. The defendant immediately called on the plaintiff to put the matter right, and following an interview, wrote on July 27th, expressing his great annoyance that an electrician had not been sent down, and stating that unless one was sent by a certain time the following day, he would take steps to have the defects rectified, and would hold Henley responsible for the cost. As Henley did not send down, Heath sent a man, who, on examination, reported that the work had been done in such a way that it could not possibly do what was required. Instead of the best material, it was stated that the material was of the cheapest, and further, it was improperly put in. For instance, in places where the wires should have been run in pipes to keep them from the damp, they were simply fastened by staples to the floor, and the wires had corroded. In view of Henley's refusal to put the work right, Heath employed a Mr. Blackwood to try to remedy it. As the family was in residence, it was impossible to make a satisfactory job of it, but Blackwood did what he could, and the cost of this was £51 10s., which was the first part of the counterclaim. While the thing was going on, Henley applied for a sum owing to him for other work not connected with Euston Hall, but in view of the position of affairs with regard to Euston Hall, Heath refused to pay over any cash. This was the sum which plaintiff claimed.

At this stage the Judge intervened, and said it was a case which must go to a referee. He was supposed to know something of law, but not about electrical installations.

Mr. Warren said, in view of this intimation, he would like to point out that there was work completed in December, 1905, and there was not a word of complaint till July, 1906. Defendant was a builder, and had a foreman on the job the whole time.

Some discussion took place as to whom the case should be referred to, and eventually the parties agreed on Mr. E. Prestwich, of Kingston.

An Electrical Engineer's Claim.

At the Brompton County Court on Wednesday last week, before Sir William Selfe and a jury, an action was brought by Edward Cale, an electrical engineer, of Macdonald Road, Forest Gate, to recover damages in respect of personal injuries from the Hans Crescent Hotel Co., Ltd.

Plaintiff's counsel (Mr. Martin O'Connor) explained that his client was helping in the work of overhauling the hotel electrical installation in the early part of the year, and an arrangement was made between the defendant company and the firm who were carrying out the repairs, to the effect that between two and four o'clock the lift should be used as little as possible while the work in the shaft was being carried out. On February 4th plaintiff went to the kitchen porter and told him he was going to start work in the shaft; but three-quarters of an hour later someone started the conveyance without giving plaintiff any warning, with the result that he was struck on the head and pressed downwards until his chest was crushed against a board at the entrance. In his struggles this board—which had, providentially, not been screwed down—gave way, and plaintiff fell out, away from the lift, which descended to the basement. In this way, no doubt, his life was saved, but his head and chest were badly injured, and for six months he had been unable to do any work.

After a number of witnesses had been called, Mr. Bastianello, the manager, stated that Cale said, after the accident, that it was his own fault. Arrangements had been made for plaintiff to have the lift when he wanted it, but he was to let witness know when he wished to work in the shaft.

The jury awarded plaintiff £50 damages, and costs were allowed.

Mr. Shakespeare, for defendants, applied for a new trial, on the ground that the verdict was against the weight of evidence; but

His Honour did not grant the application, although he said the decision would have been a different one had he been dealing with the case without a jury. Stay of execution was granted in view of an appeal.

R. Hornsby & Sons, Ltd., *v.* Babcock & Wilcox, Ltd.

The appeal of the defendants in this case from the decision of Mr. Justice Neville was down for hearing on Monday. The action was one for specific performance of certain heads of agreement, dated May 26th, 1906, for the sale by plaintiffs to defendants of "the complete water-tube boiler business of Hornsby," and Mr. Justice Neville had found in favour of the plaintiffs.

On the appeal being called on, counsel stated that the parties had been able to arrange terms. They would be drawn up and signed, and that would put an end to all matters between them.

The appeal was accordingly withdrawn.

Leyton Tramway Arbitration.

The North Metropolitan Tramways Co. has given notice of appeal against the order of the Divisional Court dismissing the application of the company to set aside or refer back to the arbitrator the award made by him in reference to the non-liability of the Council for the purchase of the car works belonging to the company in Union Road.

Re S. G. Brown's Patents.

This case came on for hearing in the Court of Appeal, consisting of the Lord Chief Justice, Lord Justice Buckley and Lord Justice Kennedy, on Wednesday, 4th inst., on the appeal of the petitioners from the judgment of Mr. Justice Neville in the Chancery Division on March 11th last.

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THE GERMAN ELECTRICAL INDUSTRY.

Leading Works Pay Higher Dividends.

It is an astonishing fact that, notwithstanding the stringency of the money market in general and the uncertain outlook in the future, the principal manufacturing firms in Germany have come forward with proposals to pay higher dividends for the year ended at June 30th, 1907, as will subsequently be seen. Only one company has actually published its annual report, the others having issued brief figures merely recording the actual results of trading. The financial figures in themselves are startling, whilst the orders declared to be on hand are so large as to pass comprehension. Apart from the question of orders, absolute silence has so far been maintained as to the future prospects of the industry.

The Allgemeine Elektrizitats Gesellschaft (General Electricity Co.), of Berlin, reports that the year 1906-7 left nothing to be desired in the matter of remunerative employment, and the turnover was 20 per cent. greater than in the preceding year. Both gross and net receipts were in excess of those obtained in 1905-6, and the net profits proposed to be distributed are stated to have been realised exclusively from manufacturing and sales business. The cost of new equipment as in the previous year was defrayed out of the revenue in the 12 months. The following statement shows the financial position for the past two years, the year ending on June 30th:—

	1906-7.	1905-6.
Share capital	...£5,000,000	£5,000,000
Gross profits	... 824,246	703,080
Expenses	... 29,229	18,479
Taxes	... 47,300	37,102
Depreciation provision	... 20,299	17,885
Net profits	... 743,408	644,447
Reserve provision ...	... 50,000	51,381
Directors' fees ...	... 20,000	15,575
Bonuses to officials ...	... 30,000	25,000
Pension fund	... 30,000	25,000
Dividend	... 600,000	511,500
„ per cent. ...	... 12	11

It is necessary to explain that, although the share capital was the same in the two years, the sum of £700,000, out of the total of £5,000,000, only participated to the extent of one-half of the dividend paid for 1905-6. The directors' report states that the machine works delivered 43,953 generators, motors, and transformers, of a total of 854,543 kw. in 1906-7, as compared with 37,424 for 602,241 kw. in the preceding year. In the turbine department, the value of the orders received increased by 55 per cent., whilst the output of the turbines ordered was 139,840 kw., as against 72,475 kw. in 1905-6. The deliveries of the apparatus factory were 10 per cent. higher, and the orders 20 per cent greater, than in the previous year. As far as concerns the Oberspree cable works, the report states that, out of the advance of £850,000 in the value of the production, about one-half was represented by the rise in the prices of raw materials. The consumption of copper alone reached 19,700 tons, as compared with 16,000 tons in 1905-6, but no loss had been sustained by the fall in the price of the metal. After referring to the introduction of a new insulating material, under the title of Tenacit, as a substitute for caoutchouc, and to the motor-car factory, it is mentioned that the sales of the glow lamp factory kept at about the same height as in the previous year. The production of metallic filament lamps had been commenced, and this was naturally at the cost of the Nernst lamps. Large orders were received in the installation department, especially from the mining and iron and steel works, and electric motors of over 10,000 h.p. were now being utilised for the driving of rolling mill trains. During the year the company completed 64 electricity works of a combined output of 95,150 h.p., and 62 central stations of 106,315 h.p. were in progress, including the works of the Victoria Falls Power Co., which would first comprise six steam turbines of 27,000 h.p. The electric motor equipment supplied to the Prussian State railways, for the Hamburg city and suburban traffic between Blankenese and Ohlsdorf would be brought into operation this year, and would be the first high-pressure single-phase main line section on the Prussian railways. The number of employés had been reduced from 33,906 on October 1st, 1906, to 30,667 on the same date of 1907, notwithstanding that the turnover increased by 20 per cent. This result is attributed to improvement in the methods of working, and to the greater activity of the employés. The directors remark, in conclusion, that the company had brought over into the new year orders of the value of £9,000,000 (180,000,000 marks), and that the orders received in the first four months of the current year not inconsiderably exceeded those which were booked in the corresponding period of 1906.

The directors of the Siemens & Halske Co. have resolved to recommend the payment of a dividend of 11 per cent. for 1906-7, as compared with 10 per cent. in the previous year. This decision has been arrived at after making abundant provision for reserve fund and for depreciation. It will be remembered that the company holds one-half of the capital of £4,500,000 represented by the Siemens-Schuckert Works, and a large portion of the former's profits consequently emanated from the latter undertaking. The Siemens & Halske Co. reports that its works continue to be well employed, and the orders in the first quarter of the new financial year not inconsiderably exceed those received in the equivalent period of last year.

The summary accounts of the Schuckert Co., of Nuremberg, pending the issue of the annual report, show gross profits of £266,511 for 1906-7, as compared with £212,565 in the preceding year. After meeting working expenses, taxes and interest charges, and making provision for depreciation, the net profits amount to £194,121, as against £160,206 in 1905-6. It is proposed to pay a dividend of 5 per cent. on the share capital of £2,500,000, as contrasted with the same rate distributed on £2,100,000 capital in the previous year.

The board of the Siemens-Schuckert Works Co., whose profits go to the two proprietory companies (Siemens & Halske Co. and the Schuckert Co.) have also made a provisional announcement for the past year. After making considerable provision for depreciation and reserve funds, it is stated that the net profits are 10 per cent. higher for 1906-7 than in the previous financial year. As the profits amounted to £449,936 in that year the figures for the past year should be about £500,000. The total volume of business transacted was 40 per cent. in excess of 1905-6. The orders brought into the new year, and those received in the first quarter, are stated to show a further augmentation as contrasted with the corresponding periods of 1906.

The directors of the Telephon-Fabrik Gesellschaft vorm. J. Berliner, of Hanover, in the course of the report for 1906-7, refer to the retirement of Herr Josef Berliner, who was manager of the Hanover house since the first establishment of the company. During the year the value of the turnover increased by 25 per cent., and the gross profits from goods and capital investments advanced from £34,112 in 1905-6, to £40,697 last year. The net profits amounted to £20,726 in 1906-7, as compared with £16,278 in the preceding year. It is proposed to pay a dividend at the rate of 10 per cent., as contrasted with 9 per cent. in 1905-6, and to form a special reserve fund of £2,500 to provide for the depreciation of raw materials since stock-taking. The report states that the employment of all the workshops is satisfactory, and the Austrian Government has given the company orders for the "automatic connection" system.

The Electric Light and Power Investment Co. (Elektrische Licht und Kraft Anlagen Gesellschaft), of Berlin, whose income arises from securities and syndicate participations and interest and commission, realised net profits amounting to £85,080 in 1906-7, as contrasted with £85,271 in the preceding year. It is proposed to pay a dividend of 7 per cent. on a share capital of £937,500, being the same rate as was distributed for 1905-6, although the loan debt is now represented by £1,060,000 in obligations, as compared with £866,500 a year ago. The directors' report refers in detail to the company's world-wide investments, including holdings in the Underground Electric Railways Co. of London. As the latter has not yielded the results which were anticipated, the Berlin company has entirely written off its holding of £5,000 in the London company's share capital, and has also written off 70 per cent. of its holding of £37,500 in 5 per cent. notes of the same company.

The liquidators of the Helios Electricity Co., of Cologne, have presented a further report in regard to this undertaking, relating to the year 1906-7. The receipts, which arose solely from interest derived from various electrical undertakings in which the company is interested, amounted to £16,211, as compared with £17,039 in 1905-6, but the whole of the former sum was absorbed by general expenses, business losses, and provision for reserves. As a consequence, the deficit of £389,000 brought forward remains unchanged. The liquidators repeat the expectation that it should be possible to bring the manufacturing and sales business to an end without further loss. The difficult point, however, was represented by the electrical undertakings in the company's possession, as the times are not favourable for the disposal of enterprises of such dimensions.

TACTICS FOR ELECTRICITY SALESMEN.

As our friends the enemy are always keen in proclaiming the advantages of gas as opposed to electricity, and as they are nowadays more than usually active in propagandist work, it is interesting to note the arguments which electrical men can best produce to meet gas competition. The Toledo convention of the Ohio Electric Light Association afforded an excellent opportunity for hearing what was to be said on the electrical side of the question, and a symposium of opinions was collected on this important subject by such men as Samuel Rust, F. H. Golding, E. T. Selig, and others, all men connected with important electric lighting and power undertakings, from which we collate the following remarks.

For lighting there appears to be a considerable leaning in favour of sliding-scale prices dependent on the hours' use per lamp. This highly controversial point appears in the majority of cases on this side of the water to be settled in favour of a flat rate, and it is interesting to note the opinion held in America on the question. Added to this the common-sense policy is recommended of developing decorative lighting to the very fullest possible extent, thus taking advantage of the facilities for hanging and fixing which pertain to electric lamps, and are not possessed by other illuminating devices. Further, it is necessary to study carefully illuminating engineering, and to give the consumer the greatest possible amount of useful light at the smallest possible cost for energy and maintenance. Street lighting is recommended as an advertisement, if for nothing else. The central station should adopt a liberal policy with reference to the connected load for which it will fix a meter and supply current. Frequently a device of negligible energy consumption acts as an opener for the extension of electric service over the entire premises. Electric irons are particularly effective in this direction. Where other arguments

and offers have failed, the electric iron has often made a way into conservative establishments for further business. One idea which has given good results is to install a certain number of services at slightly above cost, furnishing everything in the installation complete and ready for use, in order to induce the use of electricity. The average cost of installing ten or a dozen houses of various types and sizes, together with the price of a certain definite line of fixtures, plus say 10 per cent., gives a flat price per house to offer to probable consumers. The work may be paid for by the consumer in 6, 12, or 18 hire-purchase payments as may be desired. The supply authority may work either as agent to a contractor or directly with the customer. In the latter case the supply authority carries the account; in the former it guarantees the contractor against loss as a consideration for carrying the long term account.

The second aspect in the lighting problem, apart from the internal organisation and methods of the electricity supply authority, is the fighting organisation and material. For comparison purposes a room equipped with gas and electricity is recommended. One Ohio company has such a room, one half of which is equipped with an open-flame gas burner, a Welsbach burner, an inverted mantle burner, and a gas arc, so arranged that each fixture can give its maximum light unaffected by the others. On the electrical side are incandescent high-efficiency lamps and Nernst lamps with switches, arranged to give different combinations of lighting. Wattmeters and gasmeters are installed for making competitive tests. The customer relishes the scientific treatment of the subject before his eyes, and is ready to be talked to.

The fighting organisation develops from such points as reasonable rates, free renewals of lamps when these grow dim, and constant attention to old consumers. New consumers are captured through the media of newspaper advertising, letters and pamphlets, and personal canvassing. The arguments used on this basis are: the expense and maintenance of mantles as opposed to the long life and free renewals of electric lamps, their cleanliness, coolness, convenience, diminution of redecoration, facility for using electric irons, sewing machines, cooking apparatus, and other domestic appliances. The insurance side of the question is important. It is recommended that a clipping bureau be employed to furnish cuttings concerning gas accidents, working these into the local papers with acknowledgment of source of information. As regards general advertising, the two principal means adopted seem to be the electric sign, erected in the supply authority's own premises, and a contract for a little advertising space in the local paper. The localised monthly electricity magazine is recommended, and duplicated letters sent out periodically giving talks on electricity are advised.

The power problem is considerably different. The difficulty of inducing a change from gas to electric power is that, whereas practically all costs of the electric method are charged up in the price per unit, the gas engine incurs a lot of expenses which go unrecorded, and which do not figure in the gas bill. The manufacturer, not being an expert in these matters, fails to see the fallacy. The best way to tackle him is first of all to ask questions, to see if the manufacturer understands the problem, or rather, to let him see that he does not. Then the following points may be used to show that the gas bill does not represent the total expense:—The average annual amount of repairs during the useful life of a small single-cylinder gas engine varies in practice from 8 to 15 per cent. of its first cost; depreciation varies from 10 to 35 per cent. The opinions of gas engine users average out to an estimate of eight years as the best life of a gas engine. Instances are known where it is scrapped at the end of three years. Taxes and insurance must be added to the annual expense of the gas engine. The value of space occupied in crowded factories should be reckoned. The overload capacity of motors must be contrasted with the inflexibility of the gas engine. The rated capacity of the engine for ordinary fluctuating work is nearly twice that of the motor for the same work. Whereas under perfect conditions small gas engines consume about 15 cb. ft. per I.H.P.-hr. (the figures quoted by gas-engine salesmen), the average is nearly 30 cb. ft., owing to ill-fitting valves and shortage in B.TH.U. of gas used. In many cases where a gas engine has been displaced by a motor, the engine has used over 50 ft. of gas per equivalent of one KW.-hr. delivered, including gas used in overcoming engine friction. This is aggravated where lines of idle shafting have to be driven. All this affects the first cost of gas-engine plant. Money invested in any manufacturing business should earn 15 per cent.; therefore, for every £1,000 spent in gas-engine equipment, £150 should be charged to operating expense. The salary of the operator is claimed by gas men to be low. As a matter of fact, after a year or two's run the gas engine requires as much or more attention than a steam engine. This is apparent when it is considered that the stopping of a gas engine may be caused by back-firing, derangement of valves, igniters, governor gear, or mixer; wear and tear, poor design or cheap construction, sudden variations of load, &c.

With the above arguments the motor canvasser has good powder and shot. The organisation behind him is practically the same as that behind the lighting man—perhaps a little more technical, involving a knowledge of trade processes to a considerable extent.

It will be seen from the above notes of the Convention, which were reported in the *Western Electrician*, that the business-getting problem was very carefully and ably discussed, and afforded many points which can be profitably used by electricity supply men in Great Britain.

Heswall Lighting.—The P.C. has passed a resolution in favour of public lighting by electricity. A local company is to be formed to establish an electricity works.

BUSINESS NOTES.

New Zealand Tariffs.—We are indebted to a New Zealand correspondent for the following figures concerning the tariffs on electrical apparatus, &c., under the Act of September, 1907:—

Goods subject to 5 per cent. ad valorem:—

Engines and machines for mining purposes—namely, capstan engines for mining shafts; winding engines, steam, air, or electrically driven, including bedplates, foundation bolts, and friction clutches, when imported with the engines; drums for winding engines.

Steam engines, and parts thereof, for mining (including gold-dredging) or gold-saving purposes and processes, or for dairying purposes.

Goods subject to 10 per cent. ad valorem:—

Machinery, electric, and appliances, namely, electric generators, and electric motors, including side rails therefor, electric lamps, including globes for arc lamps, electric transformers.

Goods subject to 20 per cent. ad valorem:—

Boilers, land, and marine, including feed-water heaters, fuel-economisers, steam superheaters, and mechanical stokers.

Crab winches, cranes, capstans, and windlasses.

Electric batteries, and cells; furniture, fittings, instruments, and appliances, not otherwise enumerated, for the generation, transmission, application, or utilisation, of electricity, or of electric power of any description whatsoever.

Hardware, ironmongery, and hollow-ware, not otherwise enumerated.

Iron pipes wrought not otherwise enumerated, and wood or fibre pipes, exceeding 6 in. in internal diameter, also knees, bends, elbows, and other fittings for the same. Cast-iron pipes exceeding 9 in. in internal diameter, and knees, bends, elbows, and other fittings for the same.

Machinery, not otherwise enumerated.

Manufactured or partly manufactured articles of metal, or manufactured or partly manufactured articles of metal in combination with any other material whatsoever, not otherwise enumerated.

Steam engines, and parts of steam engines, not otherwise enumerated.

Spun Glass.—We have received from the CHEMISCHE FABRIK STOCKERAU (Dr. Felix Pollak), of Vienna, leaflets describing the applications of "spun glass" to electrical purposes. Brushes made of this material, it is claimed, are admirably adapted to cleaning commutators, even while they are running, owing to the insulating properties of the glass, and to the fact that the fibres do not abrade the surface of the commutator as emery does.

Germany.—The Akkumulatorenfabrik Gebr. Faust u. Scheurmann Gesellschaft is the name of a company which has just been formed in Cologne to manufacture accumulators.

Liquidation.—The P.M. ELECTRIC MANUFACTURING CO., LTD. (registered October, 1905).—A meeting is to be held at 79, Mark Lane, E.C., on January 4th to hear an account of the winding up from the liquidator (Mr. Elles Hall).

Book Notices.—*Handbook on Electroplating, Polishing, &c.* Third edition. Birmingham: W. Canning & Co. 1907.—Some years ago we gave an appreciative notice of this extremely practical handbook, which is issued by the well-known firm above-named. Amongst the additions to the contents are chapters on the agitation of solutions, by means of which the rate of deposition can be greatly accelerated; on rim plating, describing a special revolving apparatus for producing a heavy deposit on cycle rims in a short time; on the electrolytic method of cleaning work preparatory to the plating process; and special chapters on electrotyping and nickel facing for printers, &c. Instructions are also given for charging motor-car accumulators. The book is well printed, on good paper, and the illustrations are exceptionally clear. The instructions are so detailed, and the descriptions of apparatus so clear and comprehensive, that the book must be of the greatest value to all engaged in the arts dealt with, which include, besides plating, the operations of polishing, lacquering, burnishing and enamelling, together with the care and maintenance of the apparatus used.

Annuaire Universel du Caoutchouc, de la Gutta-Percha, &c. Paris: *Le Caoutchouc et la Gutta-Percha.* 1908.—This is a universal directory of the india-rubber, gutta-percha and allied industries, giving the names of manufacturers of all countries. The various manufactures are classified alphabetically, and under each such head are given the respective countries in which the manufacture is carried on, each national sub-division being filled with the individual names of makers and traders. The general heads are given in French, English and German. The arrangement does not commend itself to us as convenient for ready reference, though greater familiarity with it might modify our opinion; neither do we like the shape of the book, nor the irritating interpolation of a great number of fly-sheets asking readers to supply corrections. The work is probably, however, of great assistance to those who are engaged in the rubber and gutta-percha industries.

The Indian and Eastern Engineer Year Book, 1908. London: The *Indian and Eastern Engineer.*—This is the sixteenth issue of the year book, and contains a large quantity of information of value to those who are concerned in trade, &c., with the countries dealt with. All kinds of subjects are covered, from Hindoo holidays to electrical wiring rules for Indian installations. Customs tariffs

are given for many eastern countries, as well as postal rates and kindred information. The work also includes a diary interleaved with blotting paper, and a host of useful advertisements; as a *vade mecum*, it is an excellent desk companion.

"Science Abstracts," Part 11, No. 119, Sections A and B. November 25th. London: E. & F. N. Spon, Ltd. 1907. Price 1s. 6d. each part.

"Die Gleichstrommaschine." By E. Arnold. Berlin: Julius Springer. 1907. Price M. 20.

"Modern Views of Electricity." By Sir O. Lodge. London: Macmillan & Co., Ltd. 1907. Price 6s. net.

"Comparative Electro-Physiology." By J. C. Bose. London: Longmans, Green & Co. 1907. Price 15s. net.

Messrs. Harper & Bros. are about to issue "The Electricity Book for Boys."

"The Internal Wiring of Buildings." By H. M. Leaf. London: A. Constable & Co. 1907. Price 3s. 6d. net.

Trade Announcements.—Messrs. Andrew Brown and Co., of 110, Cannon Street, London, E.C., have been appointed agents for Messrs. Urquhart, Lindsay & Co., Ltd., Blackness Foundry, Dundee.

Messrs. Michael Pal & Co., of Parliament Mansions, Victoria Street, S.W., have been appointed sole agents for the United Kingdom and Colonies, for Messrs. Louis Schwarz & Co. Aktiengesellschaft, Dortmund, who are specialists in low-pressure steam turbines, condensing plants, cooling towers, and heat accumulators, and have special designs for efficiently cleaning blast-furnace gases, to be utilised for driving big gas engines.

The address of Messrs. Peter Brotherhood (late of Belvedere Road, S.E.) is now 53, Parliament Street, S.W.

The A.C. Electrical Co., of Snow Hill, London, E.C., has opened works and showrooms at Aberystwith, Wales, under the style of Addinell, Humphreys & Co., with works known as "Eagle Works," in Great Darkhouse Street, and showrooms in St. James' Square.

Messrs. Crosby Lockwood and Son announce that they are about to open at 121A, Victoria Street, Westminster, a west-end branch of their business, where a selection of new and standard technical publications will be kept on show.

For Sale.—On Thursday, December 12th, Messrs. Frank Cooksey & Walker will offer for sale by auction at Reading, a number of wood-working machines and electric motors. Some particulars will be found among our advertisements to-day.

Napsbury Asylum Telephone Installation. — The work under the contract of Messrs. Cox-Walkers for the installation of telephones, bells, fire alarms and tell-tale clocks at Napsbury Asylum, has been completed. After making the necessary allowances for omissions and additions, the total cost is £2,221, or £255 less than the contract price.

Consular Notes.—Japan.—The *Globe*, in quoting from Consular report (No. 3,492) on the trade in the district of Kobe, says that there exist at the present time excellent opportunities for British manufacturers in the land of the Rising Sun. In this report it is stated most emphatically that there is a great future for industrial undertakings by foreign manufacturers, or with the support of foreign capital. The report, which has recently been issued by the Foreign Office, points out that British enterprise in the direction indicated is still wanting. He goes on to say: "If British manufacturers would carefully study the import returns given in the Consular reports every year, they should have no difficulty in perceiving, not what outlets they have for their manufactures in this country, but what the prospects are of profitable manufactures (on the spot), such as the Customs tariff is specially directed against, and which, owing to want of expert knowledge and capital, the Japanese are as yet unwilling to engage in. There is good ground for believing that those who decide to venture on industrial undertakings which Japan does not yet possess, or only possesses to a small degree, will have reason to be satisfied with their experiments. In any case, it would certainly pay to send out experts, though these, unless properly introduced and provided with full powers to treat with Japanese—should a good opening be found—will have difficulty in obtaining access to Japanese industrial establishments. By visiting the country, such experts might gain much information as to what is doing in Japan."

An example of a growing industry is afforded in the case of marine motors:—It is added that with the opportunities which exist in Japan at the present time many openings for British enterprise should be found.

Johnson & Phillips's Contracts.—The following contracts have recently been placed with Messrs. Johnson and Phillips, Ltd.:—

Hankow (China).—For the Hankow Waterworks and Electric Lighting Co., Ltd., supply and erection of a complete equipment of a generating station of 1,500 kw. capacity; also outside mains and supplies. The amount of the two contracts is approximately £50,000, and the project is interesting, for the fact that it is the first case in which the Chinese have themselves formulated such a scheme and provided the requisite capital for it. Hankow has a native population of 350,000.

Bermondsey.—2,350 yd. of triple-concentric cable for the Electricity Department.

Neath.—Supply of cables to Rural District Council.

Erith.—Overhead transmission line for the Urban District Council.

Messrs. Johnson & Phillips's new cable works are now in full working order, and the firm have recently shipped some 170 tons of cable to China, as well as a large quantity of Association cable to Germany. At the present time they have also in course of manufacture the following cables in connection with the electrification of the London, Brighton and South Coast Railway. Nine miles of high-tension distributor cable, insulated with impregnated paper and sheathed with Paterson's vulcanised bitumen, also the trolley side feed cable, which is insulated with high-grade vulcanised india-rubber, sheathed with lead and copper-tape armoured. Nine miles of five-core special test and telephone cable. They further have in hand large quantities of high and low-tension pit-shaft cables, insulated with Paterson's vulcanised bitumen for several collieries in Yorkshire and Staffordshire.

Catalogues and Lists.—Messrs. Davis & Timmins, Ltd., York Road, King's Cross, London, N.—Large catalogue (page size about 17 × 13), containing numerous full-size illustrations of their well-known manufactures, including terminals, battery clamps, screws, nuts and washers for electrical work, also stocks and dies, hexagon-headed bolts, set-screws, studs and similar electrical fittings. A set of photographic views of the Wood Green works appears at the end of the book.

Messrs. A. G. Thornton, Ltd., Paragon Works, King Street West, Manchester.—This is a fine catalogue of 320 pages, in which appear fully illustrated (some examples being printed in colours) and priced particulars of their drawing and surveying instruments, also photo-tracing and other materials, among them being a number of new items which have not appeared in former editions. To enumerate all the different lines covered in the book requires two double-column pages printed in very small type, so we cannot attempt to indicate them here, but the firm's manufactures are so well known to the engineering trades that the character and variety of what they turn out needs little telling. Drawing instruments, from the single article to the most complete "Ideal" equipments, occupy the attention in about the first hundred pages; then come many things in the way of survey instruments, slide rules, drawing boards, tracing papers and cloths—indeed, we should think that everything that the heart of the draughtsman, the student, or the engineer, could wish for in these departments, is to be found here.

Messrs. Geipel & Lange, Vulcan Works, St. Thomas Street, S.E.—Eight-page priced and illustrated list relating to their Ward-Leonard motor-starters for d.c. motors.

Messrs. Heenan & Froude, Ltd., Manchester.—Neat pocket pamphlet relating to the firm's business and its manufactures, including fans for mine and other ventilation, refuse destructor plants, "Foster" patent superheaters, &c.

The Crypto Electrical Co., 155 and 157, Bermondsey Street, London, N.—Illustrated leaflet describing and stating prices of small power-motors and dynamos ($\frac{1}{4}$ and $\frac{1}{6}$ h.p.), which they have recently put on the market.

The Westinghouse Co.'s Publishing Department, Westinghouse Building, Norfolk Street, W.C.—Several publications; one describes the Westinghouse-Leblanc condensers and air pumps, and gives in tabulated form results of tests, and particulars of plants already operating or on order; two others give instructions for the erection and putting to work of simple-jet and multiple-jet types respectively.

Messrs. Babcock & Wilcox, Ltd., Oriel House, Farringdon Street, E.C.—Pamphlet No. 207, containing descriptions with illustrations of their latest appliances for the mechanical conveying of large quantities of coal, coke, and other material in bulk—silent gravity bucket and tray conveyors. Electrical engineers are pretty well acquainted with the fact that the firm has given great attention to this subject, and in this publication are some excellent half-tone photographic views of such plant supplied for Glasgow, Manchester, Brimsdown, and Radcliffe (Lanc. Electric Power Co.) Electricity Works, and various gas-works and works of other descriptions. A number of plates show detailed drawings of these different contracts.

The General Electric Co., Ltd., Queen Victoria Street, E.C.—Small booklet containing views of the "Witton" Carbon Works, also particulars and prices of the "Apostle" brand carbon for open type arc lamps, the "Witton" carbons for lamps of the enclosed type, and the "Nubia" for flame arcs.

Messrs. Siemens Bros. & Co., Ltd., Queen Anne's Chambers, Broadway, S.W.—60 pp. catalogue, finely produced and using art paper throughout, describing an interesting variety of electro-medical apparatus. The chief features of interest and novelty are as follows:—Patent tantalum X-ray tubes which can be worked with the anti-cathode at red heat; induction coils with variable primary windings; electrolytic interrupters; portable X-ray outfits; Dr. Albers-Schönberg's compressor apparatus; the protective tube stand; electrolytic valve apparatus; the Siemens orthodiagraph; and a standardised line of electro-medical switchboards.

The Jones-Westwood Electrical Manufacturing Co., Elland Road, Leeds.—Leaflet giving prices of d.c. motors of from 3 to 100 b.h.p.

The India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Silvertown, E.—Several new publications; No. 40 contains 28 pp. of tabulated information concerning "Association" electric light cables and wires, and fittings wires; No. 40A is a special price list of concentric and high-tension cables and flexible conductors and cords; a 16-page pamphlet, entitled "Cables for Electric Light Wiring," contains useful general information on the insulation of cables for internal wiring. We are asked to state that a reduction of 10 per cent. on

the prices contained in the above lists, took effect from October 24th last.

The Edison & Swan United Electric Light Co., Ltd., Queen Street, London, E.C.—Three new catalogues. One (Section 111A) gives illustrated particulars and tabulated prices of "Simplex" enamelled steel conduits and accessories. A second (Section 8, Part 3) is devoted to electric heating apparatus, and shows Dowsing luminous radiators of various very acceptable designs for private house and ship service, as well as others for office, public hall, hospital, and such-like heating. The Hatfield electrolytic wall-plug meter, enabling the consumer to have electric heating without special circuits, is also described. The third of these Ediswan publications (Section 10) covers arc lamps and arc lamp accessories. Notes concerning the construction and working of the Ediswan flame lamp are fully set out, also similar particulars relating to the "Ediswan Radiant" improved type enclosed arc, and many useful and necessary accessories, including carbons for these and other lamps.

The Gilbert Arc Lamp Co., Ltd., Chingford.—New circulars giving illustrated descriptive particulars and prices of their three types of flame lamps, viz., the 14-hour Gilbert "Flamme" lamp, type 2 flame lamp, and Magazine flame lamps (type 3).

Sterling Telephone and Electric Co., 200, Upper Thames Street, E.C.—A comprehensive catalogue and price list of telephone apparatus of all kinds (except switchboards for large exchanges), fire alarms, mine exploders, bells, indicators, batteries, &c., well printed on art paper. Loose sheets corresponding to the contents of the catalogue are stocked, affording a convenient means of forwarding information to customers. A number of interesting novelties are described, and many improvements in detail have been effected, which are most readily appreciated when examined in the large new showroom at the company's offices. An improved parallel-motion transmitter bracket, an admirable method of fixing intercommunication instruments on hinges so as to give ready access to the wiring, an ingenious device for automatic replacement in single-lever I.C. instruments, and a powerful little magneto exploder, all of which are patented, are among the recent additions to the Sterling Co.'s apparatus. An enormous number of copies of the catalogue has been printed.

LIGHTING and POWER NOTES.

Aberdeen.—The electrical engineer has been instructed to prepare a report as to what demand was likely to be put forward in the Deeside and Donside districts, and to report as to the necessary arrangements to be made—in the event of the County Council not taking over the Deeside undertaking—for a continuance of the supply from the Deeside station at Cults, pending a direct supply from the Corporation's electricity works at Dee Village.

Argentine.—It is stated that a provisional understanding has been arrived at between the city of Buenos Ayres and the German Transmarine Electricity Co. in respect of the conclusion of a new agreement. The arrangement proposes to confer upon the company a fixed concession for the whole of the city until the end of 1957, when the whole undertaking would pass into the possession of the city free of charge, together with all extensions carried out during the period of the concession. The agreement also deals with the question of maximum charges for private and public lighting, whilst 6 per cent. of the gross receipts from the sale of current will be paid to the city during the currency of the concession.

Beckenham.—The U.D.C. has applied to the L.G.B. for a loan of £4,642 for the provision of mechanical stokers at the electricity works, a battery of accumulators and booster, and extensions to buildings.

Birmingham.—The City Council has agreed to the borrowing of £231,285 for extensions of the electric supply department. It is proposed to discontinue the use of the Dale End station for generating purposes, and to transfer its load to the new Summer Lane plant. Some £20,000 is to be borrowed in respect of motors for hiring out purposes.

Brighouse.—The T.C. has applied to the L.G.B. for a loan of £3,624 for electricity purposes.

Brumby and Frodingham.—In reply to a letter from the B. of T. asking what steps were being taken to carry out the E.L. order, the U.D.C. has stated that it has the question under serious consideration, and asks for a renewal of the order for another year.

Continental Notes.—Italy.—A company has just been formed in Verona, with a capital of £20,000 and the title La Societa Elettrica Interprovinciale, to establish electric lighting and power plants in the provinces of Verona and Vicenza.

Bulgaria.—The Bulgarian Government proposes to vote a sum of £40,000 to defray the cost of establishing a large electric power transmission plant at the Pernyk Collieries belonging to the State, and situated on the Sofià-Kustendil Railway.

Turkey.—A correspondent at Constantinople declares it to be absolutely incorrect that the electricity works concession for that city, to which reference was made in this journal a fortnight ago, has been granted to a Spanish syndicate.

Eastleigh and Bishopstoke.—The B. of T. has granted the U.D.C. an extension of time for carrying out the E.L. order.

Greystones (Co. Dublin).—At a meeting of the Ratepayers' Committee of Greystones, held last week, a resolution was passed expressive of the desire of the majority of the householders not to have a Bill promoted for the public and private lighting of the town.

Guildford.—The R.D.C. has passed a resolution consenting to the application of the Woking Electric Supply Co. for a prov. order for E.L. at Ripley, Ockham, Wisley, and Pirbright.

Heysham.—The B. of T. has informed the U.D.C. that as no steps have been taken to carry out the E.L. Order, 1904, it intends to revoke the order. The Council has deferred sending its observations to the Board until the next meeting.

Hoddesdon.—In Tuesday's *London Gazette* there appears notification of the U.D.C.'s intention to transfer its prov. order to the North Metropolitan E.P. Supply Co. for £222.

India.—Karachi.—The electric lighting of the city, civil lines and cantonments, the concession for which is to be granted to Messrs. Killick, Nixon & Co. and John Fleming & Co., is being discussed with the municipal authorities.

Mussoorie.—An interesting ceremony was performed on October 4th last, when the foundation stone of the new power house for the hydro-electric scheme in progress at Mussoorie, Upper Punjaub, was laid in the presence of a distinguished company of military and civil residents. The main objects of the scheme, for which Messrs. Bruce Peebles & Co., Ltd., of Edinburgh, are the main contractors, is to provide a plentiful and reliable water supply for the "station." Certain springs have been acquired by the municipality, but these are located at a level of 1,500 ft. below Mussoorie itself, so that a powerful pumping plant was required. Owing to the abundance of water-power in the district a hydro-electric scheme was decided on. A local stream is being dammed, and a duplicate pipe line 4,500 ft. long runs down the hill to the power house, supplying water to three 300-H.P. Pelton wheels, under a 990-ft. head. The pipe line and Pelton wheels were supplied by Messrs. James Gordon & Sons, of London, as sub-contractors. Each Pelton wheel is direct coupled to a 150-KW. Peebles high-tension alternator, the combination running at 500 R.P.M. Current is to be transmitted at 6,600 volts by two overhead transmission lines, one running to the pumping station direct and the other to the town of Mussoorie and then to the pumping station, thus providing a loop system. The pumping station is being equipped with two 150-H.P. high-lift pumps, each driven by a Peebles induction motor, and either unit being sufficient for the work, the second being a stand-by. The remainder of the load on the station will be furnished by public and private lighting and motor applications. The public lighting is by means of arc lamps in the main streets and incandescent lamps elsewhere.

Leyton.—The U.D.C. is to apply for sanction to a loan of £3,750 for various extensions; the engineer has been instructed to report on the various flame arc lamps for street lighting purposes.

London.—Lambeth.—The B.C. has decided to light its various public reading rooms with Osram lamps—the remainder of the buildings will be lighted by ordinary carbon filament lamps.

Tottenham.—The North Metropolitan Electric Power Supply Co. has submitted a scheme for lighting the streets by 119 arc lamps, which has been provisionally approved by the Council.

Hammersmith.—The B.C. has agreed to purchase two motor converters from the Newcastle-on-Tyne Electric Supply Co. in connection with the supply to the Franco-British Exhibition. An agreement to supply energy to the Wolfram (Tungsten) Metal Filament Lamps, Ltd., at their proposed new factory at Brook Green, has been approved. It is expected that ultimately some 600,000 units per annum will be required.

Macclesfield.—The B. of T. having asked the T.C. what steps had been taken to carry out the E.L. Order, 1901, it has been decided to apply for a new prov. order to amend the existing one, by extending the time for laying down distributing mains, and giving the Council power to transfer the order to a limited company.

Newcastle (Co. Down).—This flourishing seaside resort, and Mecca of Irish golfers, is interested in a scheme which is being promoted by the Urban Council. This embraces a water supply, electric lighting and sewerage system at a cost of £21,450, of which the electric lighting scheme will cost £4,000.

Royton.—With reference to the application of the U.D.C. to the B. of T. for borrowing powers under the E.L. Order, 1901, the Board has replied that it has no power to sanction additional borrowing powers on the E.L. Order.

Stevenage.—The U.D.C. has decided to inform Crompton & Co., to whom the E.L. order has been transferred, that it wishes the work of establishing an electricity supply to be commenced.

Wednesbury.—At the meeting of the Town Council on Tuesday it was decided to extend the electricity mains in the King's Hall district at a cost of £196. This has been rendered necessary in consequence of the demand for electricity for lighting and power purposes. At the same meeting Councillor

Pritchard inquired when the Corporation was likely to have the sanction or the refusal of the Local Government Board to the loan in connection with the electricity undertaking. The inquiry was held nearly three months ago; but though several letters had been written to the Board, all that had been received were acknowledgments of the letters.

Wimbledon.—The L.G.B. is to be asked to sanction the borrowing by the Council of £14,000, which it is proposed to expend on installing additional plant at the works at Durnsford Road. The amount is made up as follows:—One 1,000-kw. turbo-alternator with condenser, £8,500; platforms and gangways for above, £100; two water-tube boilers and pipework, £4,000; two economisers of 160 tubes each, £1,200; boiler foundations, £200.

TRAMWAY and RAILWAY NOTES.

Australia.—The Government Commissioner for Railways and Tramways in New South Wales reports, for the quarter ended September 30th, that the tramways revenue received amounted to £228,490, an increase of £23,242; there was an increase of £19,966 in the expenditure. The number of passengers carried amounted to 39 millions. The lines have a total length of 130 miles, which are principally worked by electric traction. It is stated that as a result of the visit of Mr. C. H. Merz to Melbourne, in connection with the scheme for electrifying the city district and suburban rai'ways, an experimental equipment of the St. Kilda-Port Melbourne line may be carried out. Some 200 miles of route are included in the complete scheme.

Belfast.—The resolution for the acquirement of the Cavehill and Whitewell tramway system at the sum of £60,000 has been brought forward for confirmation, and provoked a very warm discussion, but finally the resolution was passed by 42 votes to 6. It may happen that this line will be eventually doubled, it being a looped track.

Bolton.—The scheme for connecting Bolton with Preston by means of tramways is being revived. A meeting of the Tramways Committee was held a few days ago, at which the town clerk reported an interview between representatives of the Corporation and the solicitors for the Preston, Chorley and Horwich Tramways Co., and Mr. Griffin, on behalf of the promoters who submitted proposals of the company for the Corporation to take over the company's tramways when constructed between Horwich and Chorley. Bolton is already connected with Horwich. The total length of the tramway between Bolton and Preston would be about 20 miles, but much of the district to be traversed is but thinly populated.

Continental Notes.—Italy.—The city and suburban tramway service of Milan is at a standstill owing to a strike of the employés. This state of affairs is the outcome of long-standing differences between the Edison Electric Light and Tramways Co. and its employés in the matter of wages. When the Edison Co. first provided the service under its existing wages contract, it had 163 cars with a yearly record of 9,000,000 km., whereas to-day its cars have increased to about 350, while the total working covers 25,000,000 km. annually. The company has issued a circular declaring that all tramway employés who fail to return immediately will be discharged. This decision would affect nearly 3,000 hands.

Austria.—The Vienna General Omnibus Co., which was started in 1881 with British capital, has been declared bankrupt, with heavy liabilities, due, it is said, to the competition of the Vienna Municipal electric tramways.

Sweden (Christiania).—The construction is proposed of an electric underground railway, starting from the centre of the town to Majorstuen, near the Holmen-Kollen electric tramway terminus, a place much frequented by excursionists. Majorstuen lies about 6 miles north-west of the town, at an altitude of 1,200 ft., and is, especially in February, a favourite resort for ski-running. The present line takes 25 minutes to cover the distance, and it is estimated that the proposed line will enable travellers to reach Majorstuen in 4-5 minutes. It will be necessary to construct a tunnel about 1¼ mile long. Cars made of steel are to be used, and the cost of construction, exclusive of rolling stock, is estimated at 1½ million kroner.

Holland.—The Deventer Municipal Council is treating with Messrs. A. C. Schepper and H. J. Wegeman, for the construction of a subsidised electric tramway from Deventer to Apeldoorn and Dieren. A Committee has also been formed for the construction of an electric tramway from Deventer to Apeldoorn *vid* Worsto Koeve and Beekbengen.

Leeds-Guiseley.—The Guiseley, Yeadon and Rawdon U.D.C.'s have sealed an agreement with Leeds T.C. for the extension of the electric tramways from the terminus at Horsforth through Rawdon and Yeadon to Guiseley, the extension to be completed within a year of the date of the Royal Assent to the Bill.

London.—A further development of the movement for the revision of London passenger fares was reached on December 2nd, when a conference of the railway companies was held under the chairmanship of Sir George Gibb. The following companies were represented:—The Central London Railway, the Bakerloo, Hampstead and Piccadilly Tubes, the District, the Metropolitan, the City and South London, and the Great Northern and City Railways. It is stated that a likely price would be 2s. for a book of nine tickets, available for the Central London Railway, the Hampstead, Piccadilly, and Bakerloo Tubes, and certain portions of the District and Metropolitan Railways. The area has not yet been chosen, but it is improbable that it will go further west than Hammersmith.

The Works Committee of the Fulham B.C. on Tuesday night again discussed the proposal of the County Council to install tramways in the Fulham Palace Road on the overhead trolley system. It was decided that unless the County Council was prepared to proceed with the original conduit scheme, the Fulham Council decline to further negotiate with regard to the matter.

L.C.C.—The adjourned report of the Highways Committee on the subject of the medical examination of motormen was brought forward at Tuesday's meeting of the L.C.C. and agreed to without discussion. As adopted, the resolution set forth that men who are already drivers of electric cars or are drivers of horse cars and are to be promoted to drive electric cars, who are medically examined and found to be unfit to act as motormen, should not be dismissed on that account, but be offered other employment in the tramways department at rates of pay not less than those of the lowest grade of their present employment.

An estimate of £20,500 was approved for cable and cable ducts and sub-station plant and equipment required in connection with the supply of power from the Greenwich station for working the new tramways from Hammersmith to Harlesden. Tenders for the various works were accepted as an extension of existing contracts and as set forth in the column for "Contracts Closed" in the Review a week ago. An estimate of £19,460 was also sanctioned for the construction on the overhead trolley system of lines from Wickham Lane, Plumstead, to Abbey Wood. The tenders proposed for this work and now accepted were also given in the previous issue of this journal.

Macclesfield.—Sir W. H. Vaudrey, solicitor to the tramway company, has informed the T.C. that the company proposes to abandon the tramway scheme for the borough.

Salford.—The T.C. has applied to the B. of T. for a loan of £20,000 for the provision of new tramcars, salt wagons and sand-drying apparatus.

Torquay.—Now that the condition required by the T.C. is fulfilled and the tramways are running satisfactorily over the whole of the route covered, the Dolter Co. has received formal sanction to construct an extension line along the Torbay Road, from the Strand to the railway station. This should prove a good paying part of the system, an opinion which was evidently shared by the Dolter Co., inasmuch as it has practically paid £6,500 for the concession, having agreed in return to supply and lay down wood paving for the streets and roads to that value. It is contemplated by the Dolter Co. to further extend to Paignton, a little over two miles from Torquay railway station.

U.S.A.—On November 27th a Hartford-bound train dashed at full speed into a workman's car on a level crossing at Waterbury, Connecticut, some 18 people being killed and injured. It is stated that the gates at the crossing were accidently left open, and but for a strike in the neighbourhood, the car would have carried some 70 people.

Wolverhampton.—For about a couple of hours on Wednesday evening in last week traffic was entirely suspended on every tramway section in the borough, to the great inconvenience of the public. It appears that a defective valve on one of the new boilers at the power station caused a break-down in both main feed pipes supplying the whole range of boilers. In view of the possibility of a complete stoppage of the water supply, the cars from all sections of the tramways were called in, so that they might not be stranded. There was no stoppage, however, as far the lighting was concerned.

TELEGRAPH and TELEPHONE NOTES.

Canada.—Sir Wilfrid Laurier, basing his arguments upon the experience of England, has pronounced against the Government ownership of the telegraphs and telephones; the policy of his Government will be to leave them in the hands of private companies, whilst exercising control over the rates charged.

U.S.A.—The Chicago Telephone Co.'s existing franchise expires in 1909, and the aldermen of that city have just granted to the company an extension for 20 years, so that the company can plan for extensions and improvements. A business telephone will cost $120 a year, a residence instrument $72, and a private exchange $368 per annum. A subscriber to a two-party line can get his service for $48 a year. Five cents is the rate for a message sent from a pay station, and the company is required to pay to the city, semi-annually, 3 per cent. of the gross receipts of all its business inside and outside of the city. In 1929 there will be another readjustment. Chicago should soon enjoy to the full the measured-rate system which has been such a boon in New York, and has enabled the New York Telephone Co. to give a service of

unequalled efficiency. The Chicago Telephone Co. gained 3,016 subscribers in October, and since January has added 28,098.—*Electrical World.*

Telegraphic Interruptions and Repairs:—

Cables.		Interrupted.	Repaired.
Curacao-Coro Curacao-La Guayra Curacao-Maracaibo	Closed..	Jan. 12, 1906 ..	..
Tarifa-Tangier		Jan. 18, 1904 ..	..
Port Arthur-Chifu (Closed)		Mar. 9, 1904 ..	..
Garachico-Santa Cruz		July 12, 1906 ..	..
Las Palmas-Arecife		Aug. 18, 1906 ..	Nov. 29
Brest-Dakar		July 22, 1907 ..	..
Trinidad-Demerara		Nov. 24, 1907 ..	Dec. 2
Landlines.			
Puerto-Barrios		Aug. 2, 1909 ..	..

Wireless Telegraphy.—Reuter reports that the Government of British Guiana has authorised the West India and Panama Telegraph Co. to provide wireless telegraphic communication between Georgetown and Port of Spain, the cable system being unreliable owing to the local conditions. The Government bears no part of the cost, but has agreed to continue the payment of the subsidy of £3,000 a year for five years.

The Australian Commonwealth Government has decided to install wireless telegraph installations at a number of points round the coast, the successful tenderer being required to sell his Australian rights to the Government.

The Swiss military authorities have recently received, at a wireless station on the Righi, messages in a variety of languages, from unknown sources.

Wireless Telephony.—At a recent meeting of the Association of Naval Architects, in Berlin, Count Arco, engineer and technical director of the Gesellschaft für Drahtlose Telegraphie ("Telefunken" system), stated that "Telefunken" no longer confined itself to the production of electrical oscillations by the emission of sparks; the company was now in possession of a new and reliable method, by which uninterrupted oscillations were produced by means of arcs. The company adopted this method almost exclusively for telephony. The Telefunken Co. has already standardised wireless telephone stations for military and also for ordinary purposes, and its achievements have made rapid strides during the past year. The first demonstration took place in December last year before officials of the German Imperial Post over a distance of 36 km., the messages being received by means of the 100-metre tower at Nauen. The same distance can be bridged to-day by the Telefunken Co., and the messages more clearly received, with masts only 20 metres in height. Last month messages were transmitted from Westend, near Berlin, to Rheinsberg, a distance of 75 km., and were absolutely clear when received; masts about 26 metres in height were used at both stations. The energy used was also only about one-third of that used at the earlier demonstration. In spite of the favourable results of these trials, the lecturer considered it improbable that wireless telephony would ever seriously compete with wireless telegraphy. He expressed himself as equally sceptical in regard to the general adoption of oscillations produced by means of arcs for wireless telegraphy. He considered that the spark method would become more widely used, although there was room for improvement, particularly in regard to its tuning capacity and freedom from disturbance. It is now possible to telegraph over a distance of 75 km. with a portable military station, using only 200 watts, and masts only 12 metres in height.

CONTRACTORS' COLUMN.

Openings for New Business.

ACCRINGTON.—Proposed Labour Hall and Institute.
Houses (17) in Exchange Street for Wm. Grace.

BARNSLEY.—Alterations and additions to Woodhouse Road Girls' Grammar School for the Governors.

BEAUMARIS.—New Post Office, corner of Church Street and Little Lane, for H.M. Office of Works.

BELFAST.—Extensions to works of Harland & Wolff, Queen's Island.

BLACKPOOL (Bispham).—Additions to Norbreck Hall for Mrs. Hardman.
Twenty-four houses in Ormond Avenue for S. Orme.

BOLTON.—New memorial schools. Messrs. Marsden, builders, Bolton.
Alterations to premises for Threlfall's Brewery Co., Ltd., Salford.
New offices for the Finance Committee of the Corporation.

BRIDGNORTH (Salop).—New secondary school (accommodate 200). Pritchard and Pritchard, architects, Kidderminster.

BRIGHTON.—Alterations at the Brighton Central School (£600).
Proposed new cavalry barracks.

BROADSTAIRS.—Detached residence, Cliff Promenade, for Major T. B. Robinson.

BROADSTONE (Dorset).—New factory for Rivers, Hill & Co., Ltd. Aldridge and Thomas, architects, Hinton Chambers, Bournemouth.

CADISHEAD (Lancs.).—New wall paper works (£3,000). Fram Construction Co., builders, Trafford Park, Manchester.

CARDIFF.—Proposed new mills for the United Welsh Mills Co., Cardiff.
Goods shed and offices at Newtown Yard for the Great Western Railway. G. K. Mills, secretary, Paddington Station, London, W.

CARSHALTON.—New offices, board room and fire station for the U.D.C. (£2,100).

CATTAL (Yorks.).—Additional block at the Inebriates' Reformatory, for the Yorks. Inebriates Joint Act Committee. J. Vickers-Edwards, county architect, County Hall, Wakefield.

CIRENCESTER.—Drill hall and 18 houses. Gift of Mr. D. G. Bingham (£18,950). Orchard & Peer, builders, Brinscombe.

COLNE (Lancs.).—Proposed new public baths for the Corporation. Borough surveyor.

COVENTRY.—Conversion of old post office into corn market for the T.C.
New central stores for the Foleshill Co-operative Society. G. & J. Steane, architects, 22, Little Park Street, Coventry.

COWDENBEATH (Fife).—New theatre in High Street. J. D. Swanson and Syme, architects, Kirkcaldy; South Arnold, builder.

DEVONPORT.—Alterations, &c., to the Royal Albert Hospital. E. M. Leest, architect, Mercantile Chambers, 14, St. Aubyn Street, Devonport.

DUBLIN.—Out-patients' department at the Royal Victoria Eye and Ear Hospital, Adelaide Road. Batchelor & Hicks, architects, 86, Merrion Square, Dublin.

DUNFERMLINE (Fife).—Extension of premises for F. Kelly, merchant Rumbling Well.

EDINBURGH.—New premises for the Edinburgh Life Assurance Co. J. M. Dick-Peddie, architect, 8, Albyn Place, Edinburgh.

FAKENHAM.—Buckenham Memorial Church. A. F. Scott, architect, 24, Castle Meadow, Norwich.

FARNWORTH.—Proposed Trades Hall. Mr. Rowlands, secretary, Trades Council, Bolton.

GLASGOW.—New Baptist Church at Dennistown.

GOOLE.—New Secondary School. W. T. Silvester, clerk to the Governors of the School, 10, Victoria Street, Goole.

GREAT AND LITTLE USWORTH (Co. Durham).—Poles, &c., for public lighting by electricity. J. R. Elliott, clerk to the P.C., Fern House, New Washington.

GRIMSBY.—Alterations to premises at 71, Pasture Street, for E. Ainger, manufacturing cabinet maker.

HALIFAX.—Additions to Phœbe Lane Silk Mills, for W. M. Smeeton, Ltd.
New Salvation Army Hall in North Parade.
New warehouse in St. John's Place, for T. Collinson & Sons, Ltd., wholesale grocers.

HAWICK.—Proposed Technical School. Ex-Provost Mitchell, chairman of the Hawick School Board.

HERNE BAY.—New Church at Herne. W. D. Caröe, architect, 3, Great College Street, Westminster, S.W.

HERTFORD.—E.L. installation at the Corn Exchange, for the T.C.

HOLMFIRTH.—New Council School at Scholes for the West Riding of Yorks C.C. Joshua Barrowclough & Son, architects, Holmfirth.

HULL.—Houses (20) in Whitby Street, for H. Whincop.

ILFORD.—Extensions to the Isolation Hospital for the U.D.C. (£6,920).

INGATESTONE (Essex).—Anchor Hotel to be rebuilt for the Baddow Brewery Co., Ltd. Chas. & W. H. Pertwee, architects, Chelmsford.

ISLEWORTH.—Extension to School (£3,755). H. G. Crothall, architect to Middlesex Education Committee, Guildhall, Westminster; A. & B. Hanson, Southall, builders.

KING'S LYNN (Snettisham).—New Wesleyan Church (£1,100). Gordon and Gunton, architects, Finsbury House, London, E.C.; A. Lincoln, builder.

KIRKBY-IN-ASHFIELD.—Extensions to Church Street Schools for Notts C.C. (£994). Vallance & Blythe, builders, Duke Street, Mansfield.

LANCASTER.—New Y.M.C.A. premises (£2,500).

LANGLEY MILL.—New Wesleyan Church (£4,000).

LEEDS.—Alterations to Park Temperance Hotel. J. M. Fawcett & Son, architects, 26, Albion Street, Leeds.

LISBURN (Co. Antrim).—New technical institute and free library.

LIVERPOOL (Waterloo).—New secondary school at Seaforth, lit by electricity (£18,900).
Important additions to offices and warehouses for the Great Western Railway Co. District Goods Manager, James Street, Liverpool.

LONDON (Mayfair, W.).—Enlargement of Western District Parcel Office and Mayfair Telephone Exchange. Secretary, H.M. Office of Works, Storey's Gate, Westminster, S.W.
(Lewisham).—30 houses. Norfolk and Prior, architects, Catford.
(Lewisham).—Addition to schools of Public Day School Trust. W. Holt & Sons, builders, Windmill Road, Croydon.
(Walthamstow).—Factory in Beulah Path for W. Banks.
(Hanover Square, W.).—Boiler-house and coal store for the London Hydraulic Power Co., Hatfield Street, S.E.
(Kingsway).—Buildings to be erected at the corner of Great Queen Street by Sir William Farrar, 18, Upper Brook Street, W.
(Bermondsey).—Warehouse and offices on sites of 175 and 176, Grange Road.
(Tooting).—Ten shops. J. Wright Hallett, 4, Furzedown Market, Streatham, S.W., builder.
(Wimbledon).—Nineteen houses in Dunmore Road. T. Eaton, 80, Trinity Road, S.W., builder.
(Wimbledon).—Clock tower in Lake Road. J. Smith & Sons, Ltd., South Norwood, builders.
(Hammersmith).—Factory at Brook Green for Wolfram (Tungsten) Metal Filament Lamps, Ltd.
(Wimbledon.)—Three shops, store, and two houses. Thomson and Pomeroy, Wimbledon.
(Wimbledon).—Sixty houses in Stuart Road. Ryan & Penfold, Wimbledon Park, surveyors.
(Leytonstone).—Five shops, High Road. H. E. Percy, 75, King's Road, Wanstead, builder.
(Leyton).—Sixteen houses, Newport Road. J. W. Abraham, 123, Francis Road, Leyton.
(Walthamstow).—Installation of electricity for light and power in factory of British Xylonite Co., Hale End, Walthamstow.
(Brixton).—Addition to store. H. Payne Wyatt, 18, Angell Road, S.W., architect.
(Southwark).—Installation of electric light at the Walworth Empire Theatre, Montpelier Street.
(Finchley).—Hall, St. John's Institute, Sherwood Street, for the Vicar and Churchwardens.
(Finchley).—Vicarage. Rev. S. W. Howe, St. Luke's Church.
(Poplar, E.).—Bakery for Spratt's Ltd. Max Clarke & Garbutt, 4, Queen's Square, Bloomsbury, W.C., architects.

LUTON (Beds.).—New factory near Biscot Path (£8,374). G. Dunham, builder, Guildford Street, Luton.

LYTHAM.—Proposed new Public Hall for the U.D.C.

MAIDENHEAD.—New secondary school. Plans by competition. Education Secretary, The Forbury, Reading.

MALTON (York).—Banking premises in Wheelgate for the Union of London and Smith's Bank.

MANCHESTER.—Six houses in Russell Street, Levenshulme, for Mrs. F. Ratcliffe. Leech & Ratcliffe, architects, 7, Brazennose Street, Manchester.
New Church St. Paul's, Bradford (£4,000).

MILFORD HAVEN.—New Home of Rest and Bethel, for the directors of the Sailors' Palace, Commercial Road, London, E. W. J. Wood and J. B. Gaskell, architects, Milford Haven.

NAPSBURY (Middlesex).—Additions to asylum, to accommodate 800 more beds. H. G. Crothall, architect, to Middlesex Education Committee, Guildhall, Westminster.

NEWARK.—New secondary school for the Magnus Governors. Sheppard and Lockton, architects, Bargate, Newark.

NEWCASTLE-UNDER-LYME.—New church, St. Marks, at Basford (£6,000). Austin & Paley, architects, Lancaster.

NEW TREDEGAR (Mon.).—Detached residence at Cwmsiflog, for Miss M. George. J. S. George, Bryn Gelli, Cwmsiflog.

NORTHUMBERLAND.—New schools for the C.C. at Berwick-upon-Tweed (£8,000), Hexham (£12,000), Morpeth (£4,000), Blyth (£9,000), and Wallsend-on-Tyne (£9,000).

NOTTINGHAM.—New hippodrome in the Theatre Quadrant. Thos. Barrasford, managing director, 11, Leicester Place, London, W.C.

OLDHAM.—Fifteen houses in College Road, Coppice, for the Oldham Industrial Co-operative Society.

ROCHFORD.—New public school for Essex C.C. (£3,170). J. S. Hammond and Son, builders, Romford.

ROMFORD.—New public school for Essex C.C. (£2,936). A. S. R. Ley, architect.

ROMNEY MARSH.—Proposed new laundry premises for the Guardians. Wraight & Pearson, architects, Romney Marsh.

SALFORD.—Gymnasia for boys and girls for the T.C. L. C. Evans, town clerk.

SCARBOROUGH.—Alterations and additions to the White Swan Hotel, Pickering, for J. P. Kirk. D. Petch, architect, 166, Prospect Road, Scarborough.

SHARDLOW.—New laundry at the workhouse for the B.G. (£1,387). Naylor and Sale, architects, Iron Gate, Derby.

SHEPLEY (near Huddersfield).—New saw mill for Hampson & Co.

SHILDON (Co. Durham).—Hydraulic power house at the wagon works for the North-Eastern Railway Co. Wm. Bell, architect to the company, York.

SITTINGBOURNE.—New school at Milton Regis (£3,575) for Kent C.C.

SOUTHAMPTON.—Sanatorium at Bitterne Park. Mr. Soper, builder, Southampton.

New Inland Revenue offices. S. Salter, builder, Southsea, Portsmouth.

STEVENAGE.—Banking premises. Shronder & Matthews, builders.

SWADLINCOTE.—New Roman Catholic church. Father M. Parmentier, priest.

TOBERMORY (N.B.).—New post-office accommodation required. Secretary, G.P.O., Edinburgh.

TRURO.—New hotel and garage corner of Kenwyn and Castle Streets for the Redruth Brewery Co., Ltd.

TYLDESLEY.—Proposed new Council school. H. Littler, county architect, Preston.

ULCOMBE (Kent).—New Wesleyan Church.

WALKDEN.—Proposed new mill for the Moor Spinning Co., Ltd. (new company).

New cotton mill for the Walkden Spinning and Manufacturing Co., Ltd. J. Holt, architect, 6, St. Mary's Gate, Manchester.

WARE.—Additions to St. Edmund's College, Old Hall Green.

WOODBRIDGE (Suffolk).—New Council schools (£6,279). Thos. Parkington and Son, builders, 61 and 63, Crown Street, Ipswich.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberaman (near Aberdare).—December 9th. Electrical fittings for the Powell Duffryn Steam Coal Co., Ltd., Aberaman. London offices, 101, Leadenhall Street, E.C.

Australia.—South Australia. January 8th, 1908. One common-battery switchboard and 3,000 subscribers' telephones. Commonwealth Office, 72, Victoria Street, S.W.

Barrow.—The Corporation has decided to purchase another motor-generator (cost, about £100).

Belfast.—December 28th. A double line of electric tramway, permanent way, electric masts, cables, wiring, lamps, &c., for the Belfast Harbour Commissioners. See "Official Notices" November 22nd.

Brussels.—December 18th. A public adjudication will take place at the Bourse on December 18th in regard to 74 lots of telegraph and telephone material. Specifications, No. 203, may be obtained at the Administration des Postes et Telegraphes, Place de la Monnaie.

Brussels.—December 31st. The Commandant du Génie requires tenders for the electric lighting of the Military School. Specifications, 1s. 8d., from 40, Rue de Reutiers. A deposit of £240 is required.

Darlington.—December 9th. Tramway uniforms and caps for the Corporation. See "Official Notices" November 22nd.

Erith.—December 9th. Electric lighting of 48 municipal cottages for the U.D.C. See "Official Notices" November 22nd.

France.—January 15th. The municipal authorities of Lyons are inviting projects for the establishment of a combination refuse destructor and electric power generating station.

Kingston-upon-Hull.—December 11th. Air-space telephone cable and telephone instruments for the Corporation. See "Official Notices" November 29th.

Manila.—January 15th, 1908. Sewage pumps to be worked by electric motors are required by the municipal authorities.

Rangoon.—March 31st. The Secretary of the Revenue Department, Rangoon, invites tenders for the right to exploit the rubber plantations at Mergui, in the Tenasserino district. The concession will be for 30 years, with right of extending lease for another 20 years after the end of the first period.

Spain.—Tenders have just been invited for the establishment and working of a telephone exchange in the town of Ferrol (province of Coruna).

Spain.—The municipal authorities of Pedro-Muñoz (province of Ciudad Real) have just invited tenders for the concession for the electric lighting of the town.

Valencia.—December 17th. The municipal authorities require tenders for 29 cast-iron lamp standards and accessories, estimated to weigh 2,500 kg., and the cost not to exceed 1,990 pesetas each. A provisional deposit of 2,885.50 pesetas, to be raised to 5,800 pesetas, is required. Details may be obtained from the Secretaria Municipel.

Walthamstow.—The electrical engineer has been instructed to obtain quotations for arc lamp carbons.

Warrington.—December 17th. Motors for one year for the electricity department. See "Official Notices" to-day.

CLOSED.

Chelmsford.—The T.C. has accepted the tender of Mr. F. H. Dennis, Chelmsford, for the installation of electric fire bells, at £65.

Eccles.—The T.C. has accepted the tender of Messrs. Korting Bros. for the supply of a motor-driven centrifugal pump and switchgear, at £189.

Halifax.—The Electricity Committee has accepted the tender of the British Insulated & Helsby Cables, Ltd., Prescot, for 770 yd. of ·3 sq. in. low-tension paper-insulated and lead-covered cable, for the sum of £166.

London.—Marylebone.—The B.C. Electricity Committee has received the following tenders for the supply of flame arc lamp carbons:—

Union Electric Co. (recommended).—(1) make of carbon, foreign; (2) details, quoted for in 600 mm. lengths; (3) price per 500 ft., 41·8s. (10 per cent. additional, if less than 1,000 pairs per delivery).
H. G. Mayer & Co.—(1) Austrian; (3) 33·75s.
General Electric Co.—(1) English; (3) 35·2s.
Siemens Bros. & Co.—(1) German; (3) 35·8s.
Hugo Lorenz.—(1) German, Planiawerke; (3) 38·8s.
Williams & Green.—(1) German, Planiawerke; 40·6s.
Crompton & Co.—(1) German, Conradty; (3) 42·5s.
Sloan Electrical Co.—(1) foreign, Conradty; (2) no quotation on tender, previous quotation August, 1907; (3) 42·9s.
International Electrical Co.—(1) foreign; (3) metal core 43s., coppered 26·5s., plain 29·5s.
Krupka & Jacoby.—(1) German, Siemens, Charlottenburg; (3) metal cored 44s., without 38·5s.
George Braulik.—(1) foreign; (3) 44·3s. (less 2½ per cent. on settlement).

The consulting engineer advised that the carbons of the Union Electrical Co. are of the best make and the most suitable.

The Electricity Committee also received tenders for the supply of compound, pitch and grease as follows:—

	Per ton.
Pitch.	
British Electric Trades & Bitumen Supply Co. (recommended)	£2 5 0
Jones Bros.	1 15 0
Siemens Bros. & Co.	2 8 6
F. Bird & Co.	2 15 0
Cable Accessories Co.	2 17 6
Adamant & Asphalte Co.	4 12 6
Compound.	
Craig, Sharp & Co. (recommended)	£22 0 0
F. Bird & Co.	4 0 0
Adamant & Asphalte Co.	14 15 0
British Electric Trades & Bitumen Supply Co.	16 0 0
Jones Bros.	18 0 0
A. Duckham & Co.	18 0 0
Rumney & Rumney	23 6 8
Cable Accessories Co.	25 0 0
Siemens Bros. & Co.	40 0 0
Callender's Cable Co.	42 0 0
Henley's Telegraph Works Co.	42 0 0
Grease.	
Willcox & Co. (recommended)	£2 0 0
Witty & Wyatt	16 0
R. F. Vincent	1 14 0
Croager Bros.	1 3 6
Vacuum Oil Co.	17 6

The samples in each case were analysed by Hehling & Passmore.

(*Continued on page* 939.)

TRAMWAY DEVELOPMENTS IN BUENOS AYRES.

Buenos Ayres of to-day has an estimated population exceeding 1,100,000; after Paris, it is the largest Latin capital of the world, and, by reason of its many fine buildings, its splendid avenues and parks, and the organisation of its public services, lays a very strong claim to be called the "Paris" of South America.

Among the public works of note may be mentioned the Port, thoroughly up-to-date drainage and water supply systems, and extensive railway networks; in addition, there is a large development in electric lighting and electric tramway undertakings.

The traffic within the city itself is of great magnitude, as proved by the returns of last year, which show a movement of over 200,000,000 passengers by the tramways alone. This great movement is explained by the considerable area covered by the city, which is equivalent to not less than two-thirds of that of London, and which some years ago had a horse tramway system amounting to some 280 miles.

Among the various tramway systems of Buenos Ayres, one of the most interesting is that of the Buenos Ayres Lacroze Co., the only native Argentine tramway company in the city, and the only line running a high-speed suburban service on American lines, with a private right-of-way and cars equipped for a maximum speed of 50 miles an hour.

To Mr. Federico Lacroze, one of the pioneers in tramway development in Buenos Ayres, is due the inception of the systems to be described here. His undertaking grew to a point when it became necessary to form two different systems—viz., "The City Tramway Lines," now known under the name of the "Buenos Ayres Lacroze Tramways," and a steam railway line extending from Chacarita Station in Buenos Ayres to Salto and to Zarate, a total length of 220 km. This steam line, which for long was known as the "Tramway Rural à Vapor," has recently been organised into a new company called "Ferro Carril Central de Buenos Ayres, Limitada."

The Tramways Power Plant, Buenos Ayres Lacroze Tramways.

View on the Route, showing the Lacroze Tramway Offices.

The original tramway was extended for a distance of upwards of 100 miles into the country, and was eventually converted to steam working; later, in the year 1905, a contract was entered into with Messrs. J. G. White & Co. for the reconstruction and electrification of the old city lines under the name of the "Buenos Ayres Lacroze Tramways." The work was commenced in March, 1906, and before the end of that year the new power house with a capacity of 2,250 kw., was in running order, part of the lines being opened formally to public traffic on March 10th last.

The original lines consisted of 40 km. of track owned by the company, and 10 km. held jointly with other companies and on lease.

Messrs. J. G. White and Co. are now engaged in extending these lines a further 40 km., the franchise for which was granted by the Buenos Ayres Municipality in December, 1905, and for the purpose of serving these new lines another 750-kw. set is being added to the station.

All the tracks are laid to a gauge of 4 ft. 8½ in., the rails weighing 87 lb. per yard, in 45 to 40 ft. lengths.

The rails are laid on concrete stringers, 6 in. deep and 16 in. wide, and the greater part of the paving has been executed with granite setts. Tie-bars are spaced at 3 ft. 9 in.

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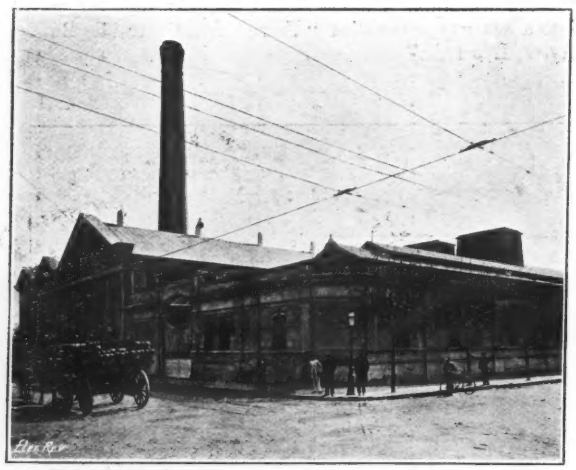
intervals, and continuous rail joints 24 in. long, weighing 77 lb. per pair have been used.

All the special work for the track was supplied by Messrs. Hadfield and the United States Steel Products Export Co.

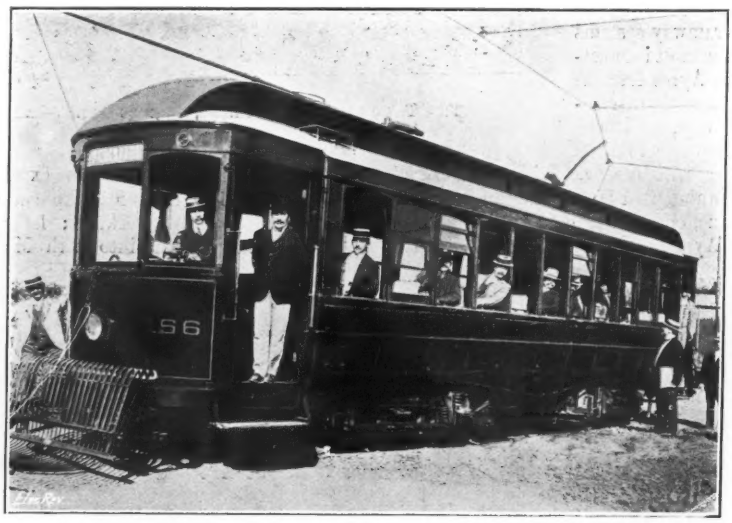


Exterior of the Tramways Power Station.

The rails are bonded by two concealed bonds, 0000 B. & S. gauge. The track is practically all laid on the level, and the radius of the sharpest curve is 45 ft.

The overhead equipment includes side and centre pole bracket-arm and span-wire construction; the poles are of steel, 30 ft. in length, in three sizes, and were supplied by Messrs. Stewarts & Lloyds, Ltd.

The trolley wire is 00 B. & S. gauge copper, suspended at a height of 20 ft. 6 in. from the ground.



Four-motor Interurban Car, Buenos Ayres Lacroze Tramways.

The power house buildings comprise an engine room, boiler house and a coal storage. A massive brick chimney has been built, its height being 156 ft.

In the engine room are installed three 1,100-I.H.P. horizontal cross-compound engines, by Carels Frères (Belgium), constructed after the Sulzer patents; these are each direct coupled to a 750-KW. compound-wound D.C. generator by the G.E.C. (New York), giving 550 volts at 115 R.P.M. The steam consumption of the engines averages 22 lb. per KW.-hour, with a load factor of approximately 40 per cent. Each engine has its own condenser of the "Contraflo" type, by Richardsons, Westgarth & Co.; the air pumps are of the Edwards type, independently driven by steam engines supplied by Allen and & Co., and the circulating pumps are of the Worthington centrifugal type, driven direct by Brown-Boveri motors.

The switchboard which is located at the end of the engine room, is of the railway type, supplied by the British Westinghouse Co., and includes three generator, three negative booster, six feeder, a Board of Trade and a lighting panel.

The panels are of marble and equipped with all the necessary instruments for a safe and rapid handling of a large traction load. At the present time one 60-KW. negative booster is installed.

A 25-ton crane, by Carrick & Ritchie, traverses the engine room.

The condensing water is cooled by two natural draught cooling towers which are of wood, the interiors being supplied by Richardsons, Westgarth & Co., whereas the materials for the shells were procured locally; each tower is capable of cooling 66,000 gals. per hour.

The present steam raising plant consists of five marine type boilers by Babcock & Wilcox, fitted with superheaters, and each capable of evaporating 12,000 lb. of water per hour.

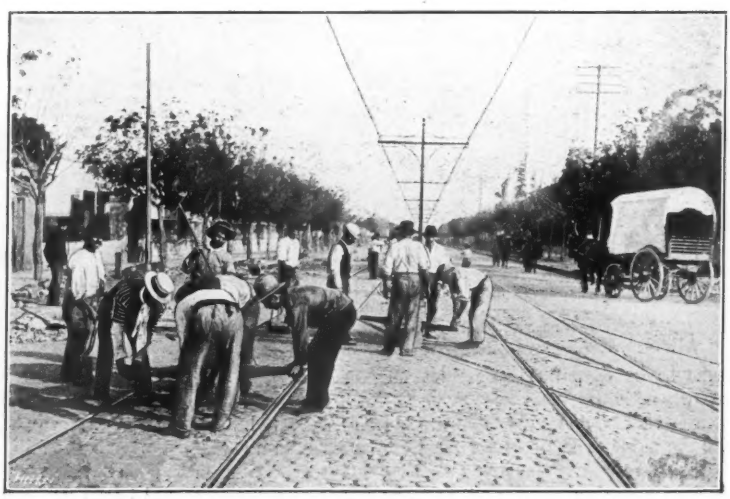
The boiler feed is supplied by three Worthington Duplex type pumps, and is heated in a Wheeler feed heater, capable of utilising all the steam from the auxiliary plant. A Paterson condensation water purifier and grease eliminator deals with the hot-well supply to the pumps.

The water supply is obtained from a well on the premises, by an electrically-driven treble-barrelled deep well pump, of Hayward, Tyler's make. A supplementary supply can also be taken from the City supply.

An electrically-operated overhead Temperley transporter with a Hone grab has been fitted in the coal store, and an Avery 20-ton weighbridge for coal-weighing purposes is provided in the yard.

The feeders have been supplied by Messrs. Callender, and are of the paper-insulated, lead-covered type, drawn into Sykes's patent stoneware conduits.

Three car-sheds house the rolling stock, which for City purposes will consist of 140 cars of the semi-convertible



Constructional Work on Suburban Route.

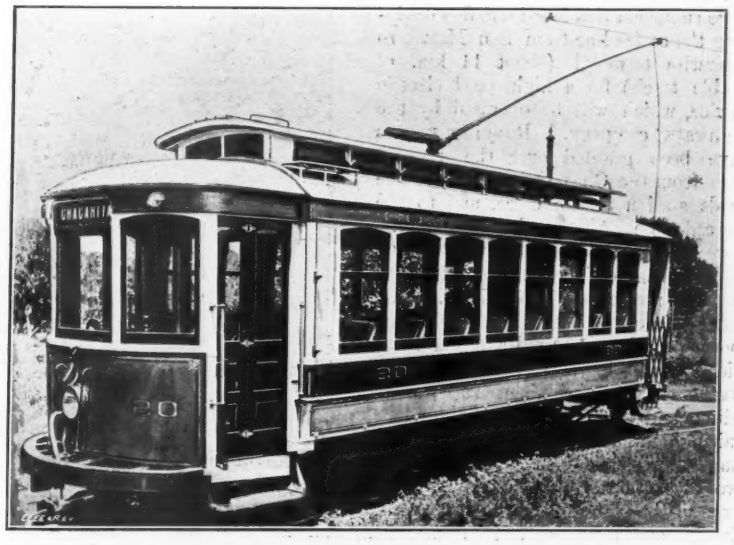
type, supplied by the J. G. Brill Co., and each seating 32 persons. Their construction allows the car to be completely shut in during bad weather, whilst at other times it is practically an open car.

The platform at each end of the car can be entirely closed if desired; it is in the form of a vestibule, having drop windows and two-leaf folding doors. Two electric ventilating fans are fitted and the cars are well lighted.

The electrical equipment includes two 40-H.P. motors supplied by the British Westinghouse Co., and capable of maintaining a speed of 15 miles per hour.

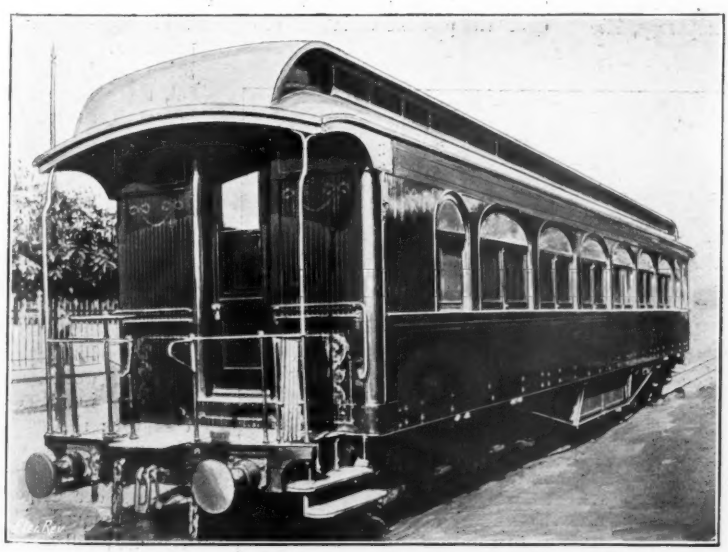
In addition to the City cars, there will be 10 interurban cars, the only difference being that these are larger, seating 44 people, and that the electrical equipment includes four 50-H.P. motors. With these it will be possible to maintain a speed of 40 miles per hour. These cars will operate over the City lines, passing on to the steam line at Chacarita and running through Lynch to the important suburb of San Martin.

Electric locomotives will also be used in connection with the heavy goods department—a large and increasing business. Messrs. Dick, Kerr are supplying these locomotives, the type used being the central cab, mounted on two four-wheeled bogies, and with an electrical equipment including four 50-H.P. motors, capable of hauling a train of 50 tons at 20 miles per hour. These locomotives will haul the freight trains of the Ferro Carril Central de Buenos Ayres and the Entre Rios Railway from Chacarita to the goods station at Once and to the Market.



Two-motor City Car, Buenos Ayres Lacroze Tramways.

The Ferro Carril Central de Buenos Ayres (formerly the Tramway Rural à Vapor) is a railway of 4 ft. 8½ in. gauge, extending westward and north-westward in the province of Buenos Ayres, from Chacarita station in the city of Buenos Ayres to the town of Salto, a distance of 174 km., with a branch 44 km. long to Zarate, a town on the Paraná River,



Buffet Car, F.C.C.B.A., for Long-distance Traffic.

and a branch of three km. from Lynch to the suburb of San Martin. It traverses one of the most fertile districts in the Argentine.

The history of the railway is believed to be quite unique, in that it was constructed as an extension of an urban horse tramway from the surplus earnings of the latter, and was operated as a horse tramway for goods and passengers for a considerable distance in a then thinly settled country. The early type of construction was necessarily very economical; the rails weighed 30 lb. to the yard, the sleepers were creosoted yellow pine 6·5 ft. long, and the bridges were supported by wooden stringers. Earthwork was avoided as much as possible, the track being laid practically upon the ground.

It became evident as early as 1891 that it would be necessary to introduce steam traction in order to cope with the traffic. Accordingly, eight 16-ton saddle-tank engines were bought, and bridges were strengthened to receive them. With the earnings of these eight locomotives, supplemented in 1896 by three 18-ton passenger locomotives, the railway was rapidly developed, gradients were reduced, rolling-stock purchased, a handsome new passenger station built at Chacarita (the B.A. terminus), the large and modern fireproof goods station built near the Plaza Once in the heart of the city of Buenos Ayres, 50 km. of line relaid with 50 lb. rails, and the 47 km. extension from Salto to Rojas begun.

The F.C.C.B.A. is at present in transition from a light railway to a standard heavy railway, occasioned by an agreement with the Entre Rios Railway. The latter, operating some 480 miles of line, has always been a purely local enterprise, separated from the city and province of Buenos Ayres by the Paraná River; similarly, the northern connections of the Entre Rios Railway, the East Argentine Railway (99 miles), and the North-East Argentine Railway (411 miles), all of the same standard gauge, are entirely separated from the rich central provinces of the Republic.

An extension is also under construction from Santo Tomé, the extreme north-eastern point of the N.E. Argentine, northward to Posadas, where, by transfer across the Alto Paraná to Villa Encarnacion, it will connect with the 250 miles of the Paraguay Central Railway. With a view to remedying its isolated position, the Entre Rios Railway made a contract with the F.C.C.B.A., by which the former will deliver its trains to the latter at Zarate, for haulage to Buenos Ayres.

Expensive works have been undertaken for carrying out this programme, and are now well under way. The Entre Rios Railway is extending its lines to Ibicui, a point on the Paraná delta, opposite Zarate. There it is building a port and ferry slip, and at Zarate it is building another ferry slip; between these points will ply a large steel transfer ferry boat (built in Scotland), with a capacity of about 30 goods wagons.

From the ferry boat at Zarate, the Entre Rios Railway is

building a connecting line to join the F.C.C.B.A. The latter is reconstructing its entire permanent way between Buenos Ayres and Zarate, 101 kilometres, using new hardwood sleepers of full size, closely spaced, and 70-lb. rails.

Partly in connection with this general plan of reconstruction, and partly as an outgrowth of the recent electrification of the Lacroze City Tramways, the F.C.C.B.A. is reconstructing its short branch to the large suburb of San Martin, and is equipping the entire line from San Martin to Chacarita terminal (about 11 km. of double track) for a high-speed electric service, which will be operated by the tramways company. Running powers have been granted over the Lacroze lines from the Chacarita Station to the goods station at the Once, and to the Mercado de Abasto Proveedor, the Covent Garden of Buenos Ayres.

The engineering and construction work entrusted to Messrs. J. G. White and Co. in connection with this railway, consists of about 100 miles of main line laid with 70-lb. Vignole rails on quebracho sleepers, and about 16 miles of sidings and yard tracks with lighter rails, also the necessary waiting and goods sheds and stations to be erected. The longest bridge is 60 metres in three spans; there are also two of 10 metres and one of 40 metres. The Lynch repair shops, situated about midway between Chacarita and San Martin, are being entirely re-modelled, and fitted with up-to-date machinery.

The F.C.C.B.A. has secured from the National Congress a concession for a further extension from Rojas north westwards to Villa Maria, about 300 km., and a further application has been made for a concession to build a small port at Zarate.

THE BELIN SYSTEM OF TELE-PHOTOGRAPHY.

We recently mentioned that a new system of transmitting pictures by telegraph had been devised by M. Ed. Belin, of Nancy. By the courtesy of our valued contemporary, *The British Journal of Photography*, we are enabled to give further particulars regarding this system, in which selenium is not employed.

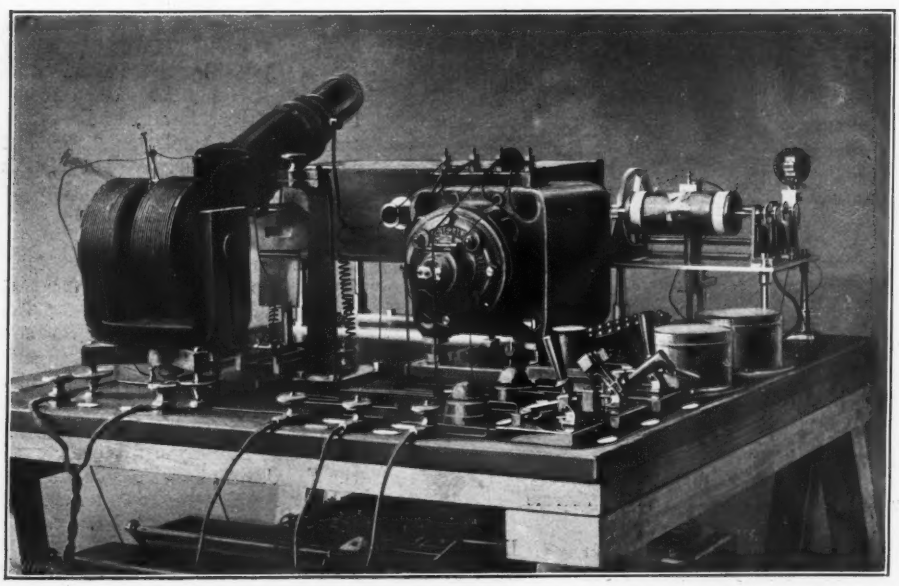


Photo by] [*Walery, Paris.*

Fig. 1.—Belin Transmitter and Receiver.

The apparatus used is shown in the accompanying illustrations, which include both transmitter and receiver, with a resistance of 4,000 ohms in circuit, equivalent to a line several hundred kilometres in length. The original photograph is a carbon print, in which the varying tones are represented by corresponding variations in relief on the surface of the print. The latter is wound on the cylinder seen at the right hand of fig. 1, which is rotated by an electric motor. The receiver, which is shown alongside of the transmitter, is provided with a similar cylinder, revolving synchronously with the first, synchronism being maintained by means of an alternating-current device. A small style rests in contact with the surface of the original print, and is traversed along it at the rate of 1 mm. for six revolutions of the cylinder; the radial movements of the style, due to the varying relief of the print, are transmitted to a small rheostat (the round disk seen close to the cylinder), which consists of 20 small plates of copper insulated from one another by mica, and connected with resistance coils. The range of 20 contacts gives, of course, an equal number of intensities of current, which is considered sufficient to cover the possible variations of contrast in photo-mechanical processes. The action being purely mechanical, there is no time-lag such as troubled Prof. Korn.

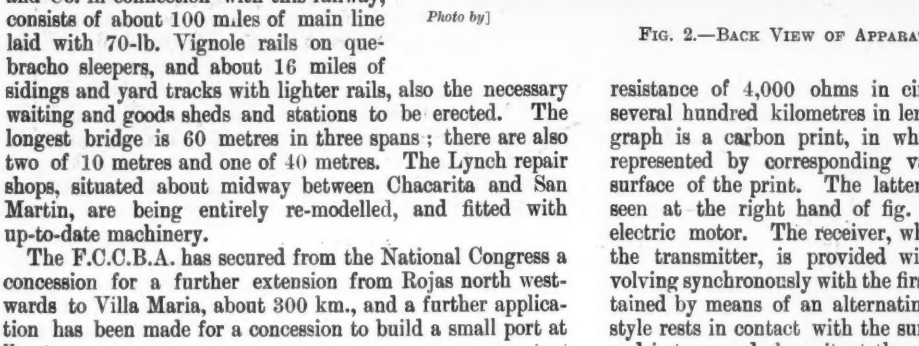


Photo by] [*Walery, Paris.*

Fig. 2.—Back View of Apparatus.

The receiver acts somewhat after the manner of the Korn receiver, in that the variations of current strength are made to vary the intensity of a beam of light falling upon sensitised paper, which is wound on a cylinder in a dark chamber; the latter is shown in one view, while fig. 2 shows the cylinder with the cover removed. The Blondel oscillograph is employed, in conjunction with the Nernst lamp projector, which is seen just behind the oscillograph. The reflected beam, before it reaches the receiver, passes through a lens and a scale of tones, as shown in fig. 3, p. 939. The points f_1 (the mirror) and f_2 (a small hole $\frac{1}{6}$ mm. in diameter) being conjugate foci, the beam reflected from the mirror is

always concentrated on the hole so long as it falls on the lens at all; but in its course it passes through some part of the scale of tones, the depth of which depends upon the deflection of the mirror. Thus the beam is caused to vary in intensity, and falling upon the hole f_2, which is practically in contact with the sensitised surface, it prints an image of the hole on the latter, of intensity proportional to that of the current, and therefore to the relief of the original print at the corresponding point.

The scale of tones can be made in various ways; M. Belin uses a photographic plate suitably exposed. By reversing

Fig. 3.—Diagram Showing Scale of Tones

the scale the print can be changed from positive to negative, if desired; and if a modified scale of tones be employed, the contrast of the original image can be increased or diminished at will.

The apparatus in its present form is susceptible of improvement, but presents great possibilities. The time occupied in transmitting an image measuring 9 × 12 cm. is about 30 minutes. In a short time the inventor hopes to be in a position to demonstrate the capabilities of the instrument over actual long-distance telegraph lines.

CONTRACTS CLOSED.

(*Continued from page* 934.)

London.—Lambeth.—The B.C. has ordered further fittings for the Council chamber, &c., at a cost of £129, from the General Electric Co., Ltd.

Walthamstow.—The Council has accepted the tender of Messrs. Henley for the supply of compounds for the electricity department.

Hammersmith.—The B.C. in June last agreed to take from the Crynant Colliery Co., Ltd., 1,000 tons of Thro' and Thro' best smokeless Welsh coal, at 16s. 10d. per ton. An offer has now been received from the company stating that, owing to a new coal seam having been opened up, they are able to offer more favourable terms, and are prepared to accept 15s. 10d. per ton for the 1,000 tons referred to, if the Council will agree to enter into a contract to take a further 3,000 tons, at 15s. 4d. per ton. The Electricity Committee has decided to accept the company's offer.

Stepney.—The Electricity Supply Committee reported on Monday that in connection with the Blythe's Wharf scheme and the sub-station at Osborn Street, only one tender was received for the complete equipment of the steam-raising portion of the plant. That tender, which amounted to £45,268, was from Messrs. Babcock & Wilcox, Ltd. A tender, at £4,293, was received from the Fulham Steel Works Co., Ltd., in respect of the supply of a coal conveyor only, and three other firms declined to quote. The reason why the specification was drawn up to provide for the whole of the steam-raising plant was that the time within which the Council has to provide for meeting the development of the undertaking in the near future is extremely short, and it would, consequently, have been better, if possible, to have had one contract, which would have facilitated the carrying out of the work. As, however, only one tender had been received for the complete equipment of the steam-raising portion of the station plant, the Committee did not see its way, having regard to the amount, and to a report on the matter by the borough electrical engineer and manager, to recommend its acceptance. It had considered the question of sub-dividing the work. The extension of the scheme which was brought up on July 31st, 1907, was divided into two parts, the first dealing with the extension which will be necessary to meet the anticipated load at Christmas, 1908, while the second will be necessary to carry the Christmas load in 1909. It would therefore appear advisable to pay particular attention to these sections of the equipment of the steam-raising portion of the station plant which will be required to meet the anticipated Christmas load of 1908. Accordingly an amended tender, the total amount of which was £8,523, had been obtained from Messrs. Babcock & Wilcox, Ltd., in respect of such sections, all of which related to boiler house equipment. The prices for the items to which the sum of £8,523 referred had, as far as possible, been checked by the borough electrical engineer and manager with corresponding prices in previous contracts with Messrs. Babcock & Wilcox, and he considered them fair and reasonable. Having regard thereto, and the fact that it was absolutely necessary that a tender should be at once accepted for the boiler house equipment, the Committee had accordingly (subject to the usual sanction) conditionally accepted the tender of Messrs. Babcock & Wilcox, at £8,523, for the boiler house equipment of the Blythe's Wharf generating station. With regard to the other steam-raising plant, the borough engineer and manager would in due course report to the Committee. For the electrical generating portion of the station plant the following tenders were received:—

British Westinghouse Electric and Manufacturing Co.—(*a*) alternative tender, £27,680; (*b*) main tender, £27,680.
Willans & Robinson, Ltd.—(*a*) £27,440; (*b*) £28,140.
Parsons & Co.—(*a*) £27,728; (*b*) £28,267.
Richardsons, Westgarth & Co.—(*b*) £28,880 (without vacuum augmentor).
Siemens Bros. Dynamo Works, Ltd.—(*a*) £28,056; (*b*) £28,820.
Brush Electrical Engineering Co.—(*a*) £30,341; (*b*) £30,491.
General Electric Co.—(*a*) £27,634; (*b*) informal.
British Thomson-Houston Co.—(*a*) £9,700 (part only); (*b*) informal.
Four other firms declined to quote.

The borough electrical engineer had visited 11 works for the purpose of making careful study of machines under construction and under running conditions, and in the confidential report which he had presented to the Committee, he unhesitatingly recommended the turbine manufactured by Messrs. Willans & Robinson, Ltd. The borough engineer was of opinion that the advantages of interchangeability were such that by paying a little more for a turbine of the make of Willans & Robinson, Ltd., the borough eventually would save financially; and this was further accentuated by the fact that the steam consumption guaranteed by that firm was appreciably lower than that guaranteed by the British Westinghouse Electric and Manufacturing Co. Having regard to this opinion, the Committee had (subject to the usual sanction) conditionally accepted the tender of Messrs. Willans & Robinson, at £28,140.

Kettering.—The following is a list of tenders received by the U.D.C., for a 315-kw. engine and dynamo, and switchboard extension:—

Name of firm.	Engine.	Dynamo.	Tender (without feed heater).
			£
W. H. Allen, Son & Co., Ltd.	Own.	Phœnix.	2,048 (accepted)
Johnson & Phillips, Ltd.	Alley & MacLellan.	Own.	2,049
Phœnix Dynamo Mfg. Co., Ltd.	Allen.	Own.	2,058
Thomas Parker, Ltd.	Alley & MacLellan.	Own.	2,069
Browett, Lindley & Co., Ltd.	Own.	Phœnix.	2,071
British Thomson-Houston Co., Ltd.	Browett-Lindley.	Own.	2,079
Do. do. do.	Allen.	Own.	2,087
W. H. Allen, Son & Co., Ltd.	Own.	B.T.-H.	2,087
Browett, Lindley & Co., Ltd.	Own.	B.T.-H.	2,087
Phœnix Dynamo Mfg. Co., Ltd.	Browett-Lindley.	Own.	2,092
W. H. Allen, Son & Co., Ltd.	Own.	Lancashire D. & M. Co.	2,111
Browett, Lindley & Co., Ltd.	Own.	Do.	2,131
W. H. Allen, Son & Co., Ltd.	Own.	E.C.C.	2,148
Electric Construction Co., Ltd.	Allen.	Own.	2,151
Browett, Lindley & Co., Ltd.	Own.	E.C.C.	2,157
Phœnix Dynamo Mfg. Co., Ltd.	Belliss.	Own.	2,158
Do. do.	Allen (triple).	Own.	2,158
British Thomson-Houston Co., Ltd.	Belliss.	Own.	2,160
Do. do. do.	Allen (triple).	Own.	2,187
W. H. Allen, Son & Co., Ltd.	Own.	Crompton.	2,191
British Thomson-Houston Co., Ltd.	Howden.	Own.	2,206
Siemens Bros. Dynamo Works Co., Ltd.	Allen.	Own.	2,217
Phœnix Dynamo Mfg. Co., Ltd.	Howden.	Own.	2,223
Electric Construction Co., Ltd.	Belliss.	Own.	2,235
Siemens Bros. Dynamo Works Co., Ltd.	Browett-Lindley.	Own.	2,236
W. H. Allen, Son & Co., Ltd.	Own.	Siemens.	2,246
Electric Construction Co., Ltd.	Allen (triple).	Own.	2,251
W. H. Allen, Son & Co., Ltd.	Own.	Parker.	2,252
Do. do.	Own.	G.E. Co.	2,253
Do. do.	Own.	Johnson & Phillips.	2,288
General Electric Co., Ltd.	Allen.	Own.	2,296
W. H. Allen, Son & Co., Ltd.	Own.	Vickers.	2,306
Dick, Kerr & Co., Ltd.	Allen.	Own.	2,307
Siemens Bros. Dynamo Works Co., Ltd.	Allen (triple).	Own.	2,314
J. P. Hall & Co.	Allen.	Own.	2,330
General Electric Co., Ltd.	Belliss.	Own.	2,376
Johnson & Phillips, Ltd.	Belliss.	Own.	2,388
Crompton & Co., Ltd.	Belliss.	Own.	2,390
Siemens Bros. Dynamo Works Co., Ltd.	Belliss.	Own.	2,392
Vickers, Sons & Maxim, Ltd.	Allen.	Own.	2,395
General Electric Co., Ltd.	Allen (triple).	Own.	2,396
James Howden & Co.	Own.	B.T.-H.	2,399
Johnson & Phillips, Ltd.	Allen.	Own.	2,401
Dick, Kerr & Co., Ltd.	Allen (triple).	Own.	2,407
Brush Electrical Engineering Co., Ltd.	Own.	Own.	2,408
Thomas Parker, Ltd.	Browett-Lindley.	Own.	2,413
Do. do.	Belliss.	Own.	2,424
Electric Construction Co., Ltd.	Willans (3-crank).	Own.	2,426
James Howden & Co.	Own.	Lancashire D. & M. Co.	2,450
Do. do.	Own.	Brit. Elec. Plant Co.	2,451
Siemens Bros. Dynamo Works Co., Ltd.	Howden.	Own.	2,462
Vickers, Sons & Maxim, Ltd.	Belliss.	Own.	2,476
James Howden & Co.	Own.	E.C.C.	2,483
Vickers, Sons & Maxim, Ltd.	Allen (triple).	Own.	2,495
Dick, Kerr & Co., Ltd.	Belliss.	Own.	2,510
Thomas Parker, Ltd.	Howden.	Own.	2,519
Do. do.	Paxman.	Own.	2,525
General Electric Co., Ltd.	Willans (3-crank).	Own.	2,581
James Howden & Co.	Own.	Parker.	2,586
Thomas Parker, Ltd.	Willans.	Own.	2,601
James Howden & Co.	Own.	Siemens.	2,663
C. A. Parsons & Co.	Turbine.	Own.	2,691
James Howden & Co.	Own.	Johnson & Phillips.	2,721

In addition to the above, alternative tenders for two-crank engines, and therefore not to specification, were received from:—The British Thomson-Houston Co., Ltd., Crompton & Co., Lt .

General Electric Co., Ltd., Dick, Kerr & Co., Ltd., and The Electric Construction Co., Ltd.

EXTENSION SWITCHBOARD PANEL.

Cox-Walkers, Ltd.	(accepted)	£191
Johnson & Phillips, Ltd.		197
Electric Construction Co., Ltd.		235
A. G. Engholm, Birmingham		235
Kelvin & James White, Ltd., Glasgow.		254

Stoke-on-Trent.—The T.C. has accepted the tender of Callender's Cable and Construction Co., Ltd., for the supply of cables for the extension to Fenton, at £4,775.

Wrexham.—The following is a list of tenders for 60-KW. steam set:—

Phœnix Dynamo Manufacturing Co.	£493
Morley Electrical Co.	506
Morris-Hawkins, Ltd.	514
Newton Electrical Works, Ltd.	521
Electric Construction Co.	528
British Electric Plant Co.	529
International Electric Co.	538
General Electric Co.	542
Mavor & Coulson	542
Jones Westwood Electrical Manufacturing Co. ..	545
Lancashire Dynamo Co. .. .. (accepted)	546
Union Electric Co.	548
P. R. Jackson & Co.	556
India-Rubber, Gutta-Percha & Telegraph Works	557
Johnson & Phillips	557
T. W. Broadbent	574
Siemens Bros. Dynamo Works, Ltd.	585
J. H. Holmes & Co.	604
British Westinghouse Manufacturing Co.	609
Thomas Parker, Ltd.	606
Ernest Scott & Mountain	602
L. H. Hodgson & Co.	921

FORTHCOMING EVENTS.

To-day's Events (Friday, December 6th).—At 2.30 p.m. Institution of Electrical Engineers. Students' visit to the B.O.T. Laboratory. Meet at the B.O.T. Laboratory, Whitehall, S.W.

At 4 p.m. Electrical Trade Meeting at Manchester *re* 1908 Exhibition. (See "Notes.")

Saturday, December 7th.—Rugby Engineering Society. Excursion to Park Royal generating station and Hammersmith car-sheds.

Monday, December 9th.—At 6.30 p.m. At the Society's Offices. Society of Engineers. Annual general meeting.

At 8 p.m. Institution of Mechanical Engineers. Graduates' Association. Paper on "Types of Water-Tube Boilers," by Mr. R. J. P. Briggs.

At 8 p.m. At Armstrong College, Newcastle-on-Tyne. Institution of Electrical Engineers, Newcastle Local Section. Paper on "Automatic Cab-Signalling for Locomotives," by Mr. J. Pigg.

Tuesday, December 10th.—At 8 p.m. Junior Institution of Engineers. At Society of Arts. Paper on "Arc Lighting," by Mr. W. Krause.

At 8 p.m. Institution of Civil Engineers. "The Predetermination of Train Resistance," by Mr. C. A. Carus-Wilson.

At 7.30 p.m. At the University, Manchester. Institution of Electrical Engineers (Manchester Local Section). Paper on "The Reluctance of the Air-Gap in Dynamo Machines," by Mr. T. F. Wall.

At 8 p.m. Institution of Electrical Engineers (Glasgow Local Section). Inspection by members, of the James Watt and Physical Laboratories of the Glasgow University.

Wednesday, December 11th.—At 7.30 p.m. At the University, Birmingham. Institution of Electrical Engineers (Birmingham Local Section). Paper on the "Torque Conditions in Alternate-Current Motors," by Mr. V. A. Fynn.

At 8 p.m. Society of Arts. Lecture on "Radio-Active Phenomena," by Sir. Wm. Ramsay, F.R.S.

Thursday, December 12th.—At 4 p.m. Meeting of Electrical Trade in London *re* Manchester Exhibition of 1908. (See "Notes.")

At 7.30 p.m. Colonnade Hotel, New Street, Birmingham. Birmingham and District Electric Club. Third annual meeting.

At 8 p.m. Borough Polytechnic Institute. Distribution of prizes, &c., by Sir E. K. Carson, P.C., K.C., M.P.

Friday, December 13th.—At 8 p.m. Holborn Restaurant (King's Hall). Electro-Harmonic Society Smoking Concert. See "Notes" to-day for particulars.

Physical Society Exhibition of Electrical and other Apparatus. (See "Notes.")

Saturday, December 14th.—At 3 p.m. Junior Institution of Engineers. Visits to the Franco-British Exhibition Buildings, &c.; the Exhibition extension works of the Central London Railway; and Central London Railway power house at Shepherd's Bush.

Thursday, December 19th.—At 7.15 p.m. At the University, Leeds. Institution of Electrical Engineers. Leeds Local Section. Paper on "The Commercial Aspects of Power Supply," by Mr. W. B. Woodhouse.

Melting Point of Tungsten.—In some recent careful determinations made by Wartenberg, the melting point of pure metallic tungsten was found to be at least 2,800° C. and probably not over 2,850° C. The determination was made by heating the metal electrically in a vacuous bulb and employing a carefully-calibrated optical pyrometer. For comparison, the same experimenter measured the temperature of the positive crater of the arc lamp, which varies somewhat with the kind of carbon used, and determined this to be 3,350°, while Reich had found 3,430° with the same kind of pyrometer.—*Electrical World.*

ELECTRICAL ENGINEERS, R.E. (VOLS.).

The following orders are issued:—

Monday, December 9th.—"A" Company. Hop. Cup Competition, 7 p.m.
Tuesday, December 10th.—"B" Company. Hop. Cup Competition, 7 p.m.
Thursday, December 12th.—"C" Company. Hop. Cup Competition, 7 p.m.
Friday, December 13th.—"D" Company. Hop. Cup Competition, 7 p.m.
Saturday, December 14th.—Corps dinner, 7.30 p.m., at the Café Monico (International Hall). Uniform, Mess or Evening Dress.

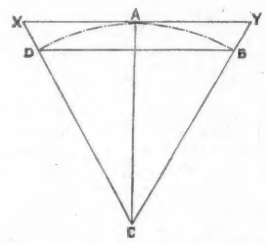
(Signed) J. H. S. PHILLIPS, Capt.,
Acting Adjutant.

NOTES.

Judges and Electrical Law-Suits.—Among our law reports published in this issue, there appear confessions uttered by two of his Majesty's judges of their inability to deal satisfactorily with the technical points involved in the trial of electrical installation disagreements. The patience of Mr. Justice Channell, as he sat hearing the case of W. Bakewell *v.* Shaw & Son at the Leeds Assize Court, seems to have been tried to the breaking point, and in sheer desperation he appealed to the parties to try and come to terms, because he would never have attempted to adjudicate upon the case had he known its character in advance. He would have referred it to an electrical engineer even then had it not been too late. His Honour Judge Selfe at the Brompton County Court was in a like dilemma when the matter of Henley *v.* Heath was before him, for it will be observed that at a certain stage in the hearing he stopped the case and sent it to a referee, remarking that "he was supposed to know something of law, but not about electrical installations."

Confessions of this sort from the Bench are infinitely to be preferred to wrong decisions, and if they go any way toward leading intending electrical litigants to refer their grievances more frequently to the less costly procedure of arbitration instead of rushing into the great expense attending trials in the public courts, more money will remain in the hands of the electrical industry, because less will go to the lawyers.

Combined Two-Phase and Three-Phase Transformation.—The accompanying illustration indicates graphically a scheme for obtaining two-phase and three-phase electromotive forces simultaneously from only four wires, for which a patent was issued to Mr. W. T. Taylor on October 29th. In this illustration C, X and Y are the terminal E.M.F. points of three delta-connected



TAYLOR TRANSFORMATION SCHEME.

transformers. Instead of obtaining three-phase E.M.F.'s from these three points, E.M.F.'s of less value in true three-phase relation are obtained from points C, D and B. The locations of B and D are so selected along the respective transformer windings that the E.M.F. C D or C B, is equal to the E.M.F. A C. Therefore, the E.M.F. D B is equal to the E.M.F. A C, and since it is in time-quadrature therewith the four points A, B, C and D give E.M.F.'s suitable for use with two-phase (independent windings) apparatus.—*Electrical World.*

Barrow and the Manchester Exhibition.—The Barrow Corporation has decided, owing to the isolated position of Barrow and to the fact that the above exhibition is not likely to be visited by many Barrow consumers, that it is unable to guarantee the sum of £29 0s. 5d. towards the exhibition, but is prepared to contribute the sum of £5 5s.

L.C.C. Contract Clause.—A correspondent writes drawing our attention to the following clause contained in an L.C.C. form of tender for the supply of tramway accessories:—"Nothing contained in this contract shall be held to restrain the Council from purchasing goods of persons other than the contractors, if it shall in its discretion think fit to do so." Naturally, he objected to this, as being based on the "Heads I win, tails you lose" principle; for obviously, if the price of the goods ruled high during the year, the contractor, nevertheless, would have to supply them at the prices quoted; whereas if the prices fell, the Council was free to go elsewhere for its materials.

A remonstrance addressed to the Council merely elicited a statement to the effect that no suggestion for modification of the clause could be entertained; and that the condition in question had for many years been inserted in all contracts for the supply of stores for the Council.

Under these conditions, our correspondent declined to tender. We have repeatedly pointed out the injustice of the one-sided clauses to be found in municipal contracts; but we suppose that as long as the struggle for orders, due to excessive competition, continues, purchasers will go on reaping the advantage which it gives them.

The Wireless Station at Glace Bay.—The *Electrical World* of November 16th gives a view of the Marconi plant at Glace Bay, Nova Scotia, which communicates with Clifden, in Ireland. The four towers are 215 ft. high, and have poles on the top of them about 50 ft. in height, giving a total height of about 265 ft. The aerial wires are about 50 in number, and are run from the top of the poles before mentioned, practically horizontally for several hundred feet in a westerly direction, dropping at the easterly end from the towers to the operating room, advantage thus being taken of Mr. Marconi's directive system. At the time of the erection of the station, it was expected that a large radial aerial would be employed, and for this reason the towers were surrounded by circles of 8 and 16 masts, each 175 ft. high, but this arrangement has been discarded for the present directive one, so that actually four towers and four masts only are now employed. Indeed, the necessity for heavily constructed wooden towers no longer exists. At the Clifden station in Ireland, they are done away with, and six poles only are used for the support of the aerials. Employed at the Glace Bay station are the manager, Mr. R. N. Vyvyan, four assistant electricians, four telegraph operators, two engineers, two firemen, two carpenters, two machinists and two riggers, so that altogether, with the families of all these people, there is quite a little colony on the cliffs. As the prime source of power, the plant has a 500-H.P. Browett condensing steam engine, driving by direct couple a 350-KW. three-phase alternator, generating at 2,000 volts, although so far only 70 KW. is utilised for the transmission of messages. Signals, when this amount of power is used, are very strong, quite sufficiently so to preclude any possible interruption of the service by atmospheric disturbances of the strength usually obtaining at this time of the year.

Etruscan Copper.—Last week at an extraordinary meeting of the first debenture-stock holders of the Etruscan Copper Estates, Ltd., Mr. E. Earle said (according to the *Financial News*) that the directors believed that, so long as the market price warranted it, their mine would always continue to be worked. Based on the figures of the past six months, with a price receivable of £65 to £68 per ton for copper, the income of the mine would balance expenditure, subject to the development work being reduced to a minimum. Several of the noted copper mines of the world were at present shut down, or, rather, they were not producing, whilst a larger number of the mines had reduced their outputs. In their case, however, there was sufficient capital available to continue development work. They would certainly have gladly adopted the same course had their available capital warranted it, the more especially as the ore of late disclosed in their workings at Earle Shaft was of a higher quality than that at other parts of the mine. They were of opinion that if the price of copper which could be securable by them should rise to £75 or £80 per ton, the mine would again be worked at a profit sufficient to pay the annual interest on debentures, especially if the larger furnace were to be put into commission. It would be obvious that the course adopted by the board—viz., that of stopping production—was the right one under the circumstances, as there was no sense in running the mine for the mere sake of running it, as thereby they should have been simply eating up their ore reserves without any equivalent.

The Irish Exhibition Losses.—The *Daily Mail* quotes Mr. James Shanks, the chief executive officer of the Irish International Exhibition, as saying that the deficit of £100,000 is mainly due to bad weather conditions. Among the principal guarantors were Messrs. Humphries, contractors, £26,000; the Dublin Tramways Co., £12,500; and Mr. W. M. Murphy, £1,500.

Electrically-Driven Ships' Propellers.—The electrical driving of ships' propellers was brought forward by Herr Schulthes, of Berlin, in a paper read on November 25th before the German Institution of Naval Architects, at the ninth annual meeting held in the Technical High School at Charlottenburg. The author discussed the advantages of different systems, and pointed out that by means of them a number of vessels, in which direct driving by very high-speed engines was not applicable to the screws, could be worked economically and with good capacity for manœuvring. So long as really practical and reversible internal combustion engines could not be produced, the assistance of electrical driving of propellers was advantageous, and for certain kinds of ships electrical operation was presumably the solution of the question of the turbine-engined vessel. By means of electrical operation of the propeller it was possible to control the screws direct from the bridge. The control of ships thus equipped would in future, from the standpoint of speed and dirigibility, in a similar way to a motor-car, be directly effected by the officer in charge on the bridge.

A Canadian Contemporary.—The *Canadian Electrical News* has changed hands. In the November issue Mr. C. H. Mortimer, after 17 years, says "Farewell" to his readers, and the new proprietors, Messrs. Hugh C. MacLean, Ltd., announce briefly their plans for the future. Among other things, there will be a "determined policy of improvement." This we shall watch for with some anxiety, for we observe that in an advertisement, applicants for the position of city electrical engineer to Sydney, N.S.W., are seriously told that they should obtain certain particulars from "*Preece Cardew, Electrical Engines.*" We wish the new proprietors success with the paper in its altered form, and have no doubt that they will have it in a land of so bright an electrical future.

The Bidwell Swindle.—For some time past the Bidwell Electric Co., of Chicago, has been advertising the sale of stock in its "cold motor," making most absurd statements and claims. Any number of inquiries about it have been addressed to this office. A federal warrant charging the use of the mails for fraudulent purposes has now been issued, and on November 1st, Charles F. Bidwell, the secretary, was taken into custody after a fight, and, failing bail in $3,000, went to jail. A warrant is also out for Benson H. Bidwell, president of the company. It is said that 4,330 investors have bought at least $200,000 of the stock.—*Electrical World.*

Fire.—According to Press despatches from Melbourne, there was a great fire there which destroyed, among other buildings, the Federal Government Telegraph and Telephone Stores. Here, according to one report, there were some 7,000 telephones. Another report states that the losses included £30,000 worth of uninsured Federal electric plant.

Employment in Canada.—According to a paragraph in the *Times*, there is no present scarcity of engineers and land surveyors in Canada. Lord Strathcona, High Commissioner, is informed by the Minister of the Interior at Ottawa that there will be no work in Canada for surveyors or engineers before next spring, by which time it is expected that the demand will be fully met by those on the spot.

Electric Anti-Fouling Brush.—According to the *Morning Post*, an apparatus has been devised, and is under trial in the British Navy, for the removal of the fouling from ships' bottoms by means of brushes with electro-magnetic control. The brushes are pulled to and fro under the plates, and are held in contact with the latter by electro-magnets—the objection to brushes not thus equipped having been up to now the difficulty of applying them to the plating with sufficient force. It is stated that by this means a ship can be cleaned in a few hours, without going into dock.

Electro-Harmonic Concert.—On Friday evening, December 13th, at the King's Hall, Holborn Restaurant, will be held the next smoking concert of the Electro-Harmonic Society. Mr. George Sutton will preside, and the arrangements as announced in the programme are as follows:—Solos and duets by Messrs. Alfred Heather and Ivor Foster; violoncello solos by Mr. Joseph Schofield; violoncello and piano duet by Messrs. Schofield and Izard; concertina solos by Mr. Alexander Prince; artistic sketches by Mr. Harry May Hemsley; humorous songs by Mr. Will Edwards; and a ventriloquial sketch by Mr. Arthur Prince.

Manchester Electrical Exhibition, 1908.—As announced in our last issue, a meeting of the Electrical Trade is to be held to-day at Manchester regarding the above. It will be presided over by Mr. E. H. Langdon, the President of the Manchester Chamber of Commerce, in the boardroom of that Chamber, 44, Mosley Street, at 4 o'clock p.m. The London Electrical Trade meeting, at which Sir William Preece, President of the Electrical Exhibition held at Olympia in 1905, will take the chair, is convened for Thursday, December 12th, at 4 o'clock, at the Hotel Cecil. It is greatly to be hoped that in each case the gathering will be a representative one.

Three-Phase Locomotives for a Swiss Railway.—Work has just been started on a very important electric railway project—the Arlberg line, a link in the line from Vienna through Switzerland to Paris; being the only direct line east and west between these two points, it carries the greater portion of the traffic. Electric locomotives, more powerful than any steam locomotives available, will handle trains of considerably greater weight, and they will be run at speeds from 25 to 30 per cent. higher than the present locomotives. It is estimated that the total service of the line will be increased by at least 50 per cent. with a comparatively small capital outlay as compared with the tremendous expense which would have been involved in any grade reduction or in the building of additional tracks, the only other means for increasing the service of the road. It is stated that the electrical equipment will cost only one-fifth of the double-tracking, and the operating expenses will be decreased by 25 per cent.

The Arlberg line is a typical mountain division between Innsbruck and Feldkirch, about 140 miles long, single track except for a double-track tunnel at the summit about 7 miles long. The maximum grade on the east side of the tunnel is 3·14 per cent., and that on the west side 2·64 per cent. The curves are numerous, but are of fairly large radius. At present there are about 40 trains daily over the line in each direction, about one-third being passenger and the rest freight. Prof. C. L. de Muralt, of the University of Michigan, has been appointed consulting engineer in charge of this project by the Austrian State Railways. Prof. Muralt has decided to equip the line with three-phase alternating-current locomotives, principally because it has been found that the three-phase locomotive is more powerful for any

given weight than either the direct current or single-phase. The draw-bar pull and speed which are specified, demand an output of practically 3,000 H.P. from a locomotive weighing not more than 60 tons—a requirement which has not thus far been met by any but three-phase locomotives. In addition to this, it is estimated that some £40,000 will be saved annually by the return of energy to the system by trains descending the grade, and there will be the saving in maintenance of brake rigging and wheels made possible by electric braking.

There will be about 50 locomotives, of which five or six will be for reserve. The hydro-electric station will have a maximum output of about 40,000 KW. It is probable that two separate stations will be built, one on either side of the tunnel. Two years is the estimated time for the completion of the entire plant, and at the expiration of that time the entire steam equipment of the road will be supplanted by the three-phase locomotives.—*Electrical World.*

The Imperial College of Science and Technology.—The Earl of Crewe, chairman of the Governing Body of the Imperial College of Science and Technology, has authorised the publication of the following communication:—The Governing Body of the Imperial College of Science and Technology have appointed three standing committees, a Finance Committee (chairman, Sir Francis Mowatt), an Education Committee (chairman, Mr. Arthur Acland), and a General Purposes Committee (chairman, Lord Halsbury). In addition, they have appointed two temporary committees, a Transfer Committee (chairman, Mr. Arthur Acland), and an Organisation Committee (chairman, Mr. Gerald Balfour, vice-chairman, Sir William White). Matters relating to the transfer to the Imperial College of the constituent institutions, which it has been arranged shall take effect as from January 1st next, and to the transfer of land from the Exhibition Commissioners, have been referred to the Transfer Committee. The Organisation Committee, to which have been referred matters relating to the future organisation of the Imperial College, have appointed four sub-committees to consider questions arising under this head in relation to the following sciences or groups of sciences, viz.:—(1) Mining and Metallurgy (chairman of the sub-committee, Sir Julius Wernher); (2) Other Branches of Engineering (chairman, Sir John Wolfe Barry); (3) Biological Sciences (chairman, Sir Archibald Geikie); and (4) Other Pure and Applied Sciences (chairman, Sir Arthur Rücker). The Governing Body have authorised the appointment of persons not members of the Governing Body, who are specially conversant with the sciences in question or with their industrial applications, as additional members of these sub-committees, which are now engaged in considering the questions referred to them. The Governing Body have also approved in principle the appointment of a principal officer of the Imperial College, and have referred the question of his title and functions to the Organisation Committee.

Appointments Vacant.—Switchboard attendant for Paisley; junior shift engineer for Southport (£65).

Receiver Appointed.—We learn that owing to the action of a creditor, the debenture-holders of D. Santoni & Co. (1906), Ltd., have appointed a receiver.

Institution and Lecture Notes.—AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.—In an address recently delivered before the Schenectady chapter of the A.I.E.E., Mr. T. C. Martin, who has filled every office in the Institute except that of treasurer, eulogised the worth and ability of Mr. Ralph W. Pope, the secretary, and remarked that the Institute had grown from 250 members with an income of $1,000 in 1886 to 5,000 members with a budget of $70,000 in 1907, outstripping the membership of the older engineering societies. The library at the new Engineering Building, he said, together with the Public Library in the next street, would form the most comprehensive collection of scientific and literary works in the world. Codes of ethics were the latest efforts at standardisation by the Institute; it was a good thing to have them, but they must not expect too much from such codes.

NORTHAMPTON POLYTECHNIC INSTITUTE.—On Friday evening last the Duke of Connaught distributed the prizes and certificates to students at this Institute. The Principal (Dr. R. Mullineux Walmsley) as usual showed the increasingly successful work that the Institute was doing, by reading a summary of the annual report. After a few words from the Chairman, Mr. L. B. Sebastian, his Royal Highness addressed the gathering, referring, among other things, to the advantages brought by such institutions to the rising generation, and to the smart appearance of the company of Volunteers who had honoured him as he entered. After the prizes, &c., had been distributed, an inspection of the workshops and laboratories took place. In accordance with the custom adopted in recent years, the members' and students' annual conversazione was held on the following (Saturday) evening.

PHYSICAL SOCIETY OF LONDON.—The third annual exhibition of electrical, optical, and other physical apparatus will be held on Friday, December 13th, 1907, from 7 p.m. to 10 p.m., in the Physics Laboratory of the Royal College of Science, Imperial Institute Road, South Kensington.

From the programme, there appear to be many items of considerable interest to both physicists and electrical engineers. Invitations have been given to the Institution of Electrical Engineers, the Faraday Society, the Optical Society, and the Röntgen Society. Members of the societies mentioned who desire to attend the Exhibition should apply to the secretary of the society to which they belong.

ROYAL INSTITUTION.—The following are included in the lecture arrangements before Easter:—Mr. R. T. Glazebrook, two lectures on "Physics"; Prof. Gisbert Kapp, "The Electrification of Railways"; Prof. J. J. Thomson, six lectures on "Electric Discharges Through Gases." The Friday evening meetings will commence on January 17th, when Prof. T. E. Thorpe will deliver a discourse on "The Centenary of Davy's Discovery of the Metals of the Alkalis." Succeeding discourses will probably be given by Prof. E. Rutherford, Sir Oliver Lodge, Prof. J. Milne, the Hon. R. J. Strutt, Prof. J. J. Thomson, and other gentlemen.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. A. M. MULLINER, of Southport, was on November 27th appointed assistant electrical engineer for the borough of Eccles.

MR. FIRTH, assistant engineer at the Whitby U.D.C. electricity works, has been appointed chief electrical engineer to the Minehead Electric Supply Co.

The Rugby U.D.C. has increased the salary of MR. SHENTON, manager of the electricity works, from £165 to £180 per annum as from December 1st.

On Saturday last, at the York Corporation electricity works, Mr. Hame, the city electrical engineer, on behalf of the staff and employés, presented MR. G. H. B. HOLMES, on the occasion of his marriage, with a case of solid silver teaspoons and sugar tongs, suitably inscribed.

MR. S. S. FOSTER, of the Derbyshire and Notts. Power Co., has been appointed chief assistant at the Hoylake and West Kirby electricity works.

Tramway Officials.—In connection with the Halifax tramways reorganisation scheme, after considering a report by the new chairman of the Halifax Tramways Committee (Councillor C. F. Spencer), and his vice-chairman (Councillor David Hanson), it has been decided: (1) That the office of general manager of the tramways be combined with that of the electrical engineer; (2) that subordinate officers should be appointed (*a*) traffic superintendent; (*b*) rolling stock superintendent. It appears to the Committee that the electrical engineer, having the desired qualification, is the most competent officer to take complete control of all electrical and mechanical work. On the other hand, the commercial or traffic branch is a department which has its reflection in statistical returns, and needs little control from a general manager, who, before he can alter any of the conditions, is subject to the will of the Tramways Committee, who must direct matters of policy; hence the departments, for which a general manager is mostly needed are technical as distinguished from commercial. It is expected there will be a stiff discussion at the Council meeting when the proposals come up for consideration.

MR. DAVIES, recently clerk of works for the Accrington Corporation, will receive remuneration equal to three months' salary for extra services in connection with the reconstruction of the tramways. There are 140 applicants for the position vacated by Mr. Davies.

MR. R. L. M'CULLOCH, traffic manager to the Merthyr Tydfil Electric Traction Co., has been appointed general manager to the Leamington and Warwick Electric Traction and Lighting Co., Ltd.

On Thursday last week at a social meeting of the employés of the Aberdeen Corporation electricity department, over which Mr. J. A. Bell, city electrical engineer, presided, MR. T. WILKINSON, the chief assistant tramway superintendent, was presented with a case of silver fish knives and forks and a correspondence case. Mr. Wilkinson is leaving to take up a position as outside superintending engineer with the British Insulated and Helsby Cables Co., Ltd. In making the presentation Mr. Bell said that for the past eight years Mr. Wilkinson had been his right-hand man in tramway matters. The Hall was festooned with "Fairyland" strip.

General.—MR. A. L. BOYLE, who recently completed his engagement as electrical engineer to the Caucasus Copper Co., Ltd., and was formerly with Thornycroft & Co., Ltd., and Ferranti, Ltd, has been appointed to the post of chief assistant on the staff of May & Hawes, consulting engineers of Caxton House, Westminster.

MR. L. W. MIGOTTI, until recently rolling stock engineer to the Great Northern, Piccadilly and Brompton Railway, was the recipient of a gold hunter watch at a smoking concert held at the Grove Tavern, Hammersmith, on the 23rd inst. The watch was subscribed for by his late colleagues and employés, and was presented by Mr. A. Rayner, chief clerk to the superintendent of the line. Mr. Migotti leaves London to-day, December 6th, for Buenos Ayres to join Mr. Pakenham W. Beatty, who is head of the electrical undertakings of the Buenos Ayres Pacific Railway Co.

MR. G. O. MCLAREN has resigned his position with the British Westinghouse Electric and Manufacturing Co., Ltd., to join the firm of Messrs. Stothert & Pitt, Ltd., of Bath.

Consequent upon the death of Mr. C. Montgomery, which was announced in our pages on October 25th, the following altered arrangements have now been made in the Electrical Review Advertisement Department:—Mr. Osborne Pearston, whose activities have chiefly been exercised in the provinces up to the present, will call upon customers and friends in London and neighbourhood, and Mr. H. Porter-Cox, who has just joined the Review staff, will deal with the ground formerly covered by Mr. Pearston.

Obituary.—At the inquest concerning the death of Mr. Andrew Wilkes, electrical engineer under the Auckland Electric Tramways Co., Ltd. (see Electrical Review, November 29th) a verdict of suicide while mentally deranged was returned. Mr. Walklate, the general manager, in his evidence testified to the admirable manner in which Mr. Wilkes carried out his duties. Deceased was 26 years of age. The police were unable to find anything among deceased's effects that would throw any light on the tragedy.

NEW COMPANIES REGISTERED.

London Electric Supply (Joint Committee), Ltd. (95,869).—This company was registered on November 29th, with a capital of £10,000 in £1 shares, to promote a Bill or Bills in Parliament (*a*) making further provisions for the supply of electrical energy in the County of London and in the surrounding districts in Kent, Surrey, Middlesex and Essex; (*b*) providing for the incorporation of a Joint Committee, and defining its constitution, powers and obligations; and (*c*) altering, modifying or revising the existing statutory provisions applicable to the companies or local authorities empowered to supply electrical energy within the said area, and conferring other powers on them, &c. The first subscribers (each with one share) are:—W. F. Fladgate, 60, St. Martin's Lane, W.C., chairman of Charing Cross, West End and City Electricity Co., Ltd.; J. Harrison Cripps, 16, Stratford Place, W., chairman of Metropolitan Electric Supply Co., Ltd.; R. Stewart Bain, 25A, Cockspur Street, S.W., managing director of London Electric Supply Corporation, Ltd.; F. Irving Courtenay, 19, Cadogan Gardens, S.W., chairman of Chelsea Electricity Supply Co., Ltd.; H. R. Beeton, Richmond Road, Earl's Court, S.W., chairman of Brompton and Kensington Electricity Supply Co., Ltd.; H. St. J. Winkworth, 37, Tranquil Vale, Blackheath, S.E., chairman of South Metropolitan Electric Light and Power Co., Ltd.; J. B. Braithwaite, 1-2, Great Winchester Street, E.C., chairman of City of London Electric Lighting Co., Ltd.; and R. P. Sellon, Moorgate Court, E.C., director County of London Electric Supply Co., Ltd. No initial public issue. The shares (except those issued to the subscribers) shall be held by the following companies:—The Brompton and Kensington Electricity Supply Co., Ltd.; the Charing Cross, West End and City Electricity Supply Co., Ltd.; the Chelsea Electricity Supply Co., Ltd.; the City of London Electric Lighting Co., Ltd.; the County of London Electric Supply Co., Ltd.; the London Electric Supply Corporation, Ltd.; the Metropolitan Electric Supply Co., Ltd.; and the South Metropolitan Electric Light and Power Co., Ltd.; or some of them, or such other companies as may become shareholders. The board of directors is to consist of one representative of each of the said companies. Remuneration as fixed by the company. At board meetings each director shall have one vote for each share held by the company he represents. Votes at general meetings: one vote for each share.

Denton Electrical Construction Co., Ltd. (95,884).—This company was registered on November 30th, with a capital of £1,000 in £1 shares, to carry on the business of electricians, electrical and mechanical engineers, manufacturers of and dealers in dynamos, motors, engines and any apparatus used in connection with the generation, distribution, supply and accumulation of electricity, &c. The first subscribers (each with one share) are:—J. Hallsworth, 11, Ashton Road, Denton, jeweller; G. S. Aveyard, Parkfield, Warwick Road, Romiley, engineer; Ann Hallsworth, 11, Ashton Road, Denton, telephone operator; H. Hallsworth, 11, Ashton Road, Denton, engineer; Mrs. H. Aveyard, Parkfield, Warwick Road, Romiley; D. Oldham, 85, Bennett Street, Newton, Hyde, accountant; and E. B. Russell, 1, Fennel Street, Manchester, chartered accountant. No initial public issue. Registered without articles of association. Registered office, 11, Ashton Road, Denton, near Manchester.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

South Metropolitan Electric Light and Power Co., Ltd. (47,875).—Issue on October 22nd of £13,500 4½ per cent. debentures, part of series created by resolutions of July 3rd, 1900, and May 6th, 1904, to secure not more than the amount of the share capital paid up for the time being, charged on the company's undertaking and property, present and future, including uncalled capital. The debentures are issued to the trustees for further securing debenture stock covered by trust deeds of August 3rd, 1900, and June 3rd, 1904. Trustees: H. R. Beeton, 18, Austin Friars, E.C., and W. R. Davies, 10, Moorgate Street, E.C. Previously issued of same series: £237,968.

Nairobi Electric Power and Lighting Co., Ltd. (87,228).—Four scrip certificates, for £2,000, £2,000, £1,000 and £200 respectively, all dated October 30th, 1907, have been registered. Property charged: The company's undertaking and property, present and future, excluding £1,500 deposited with the National Bank of India, capital uncalled on 16,000 shares to be subsequently numbered, and a contract between the Crown agents for the Colonies and C. Hirtzee, except as the company may include the latter in the charge with the consent of H.M. Commissioner for the East Africa Protectorate or the said Crown agents on his behalf. No trustees. The scrip certificates are issued as interim security, to be afterwards exchanged for debentures.

Lancashire Dynamo and Motor Co., Ltd. (61,447).—Issue on November 5th of £65,000 5 per cent. first mortgage debentures, part of series created by resolutions of March 4th and June 24th, 1907, to secure £75,000, has been filed. Property charged (by trust deed of March 4th, 1907, already registered): Land at Trafford Park, with works, plant, &c., thereon, and the company's undertaking and general assets, except uncalled capital. Trustees: E. F. Sheppard, 55, King Street, Manchester, and A. Tongue, 86, King Street, Manchester. No previous issue of same series.

Britannia Electric Lamp Works (1905), Ltd. (86,967).—Particulars of £600 second debentures, created by resolution of October 18th, 1907, have been filed pursuant to Section 14 (4) of the Companies' Act, 1900. Property charged: The company's undertaking and property, present and future, except uncalled or unissued capital. No trustees.

Isle of Wight Electric Light and Power Co., Ltd. (53,823).—An acknowledgment of indebtedness, dated October 28th, 1907, creating a further £25,000 debenture stock (making, with £75,000 already created, a total of £100,000 debenture stock, and being supplemental to a trust deed of October 21st, 1903, covering £50,000, and an acknowledgment of indebtedness dated July 25th, 1905, covering £25,000, of such stock) has been registered. Property charged: The company's undertaking and property, present and future, including uncalled capital. Trustees: P. de M. Cavell, J.P., Red House, Slade End, Wallingford, Berks; and W. R. Davies, 10, Moorgate Street, E.C.

Edison & Swan United Electric Light Co., Ltd. (18,984).—This company's annual return was filed on November 6th, when 116,400 "A" and 23,564 5s. "B" shares had been taken up out of a nominal capital of £888,071 in 150,000 "A" and 26,436 "B" shares of £5 each and 23,564 "B" shares of 5s. each; 10s. per share has been called up on 89,261 "A," and £44,630 10s. has been received; £344,738 10s. is considered as paid, being £5 per share on 17,139, £2 10s. per share on 89,261, and £3 per share on 10,000 "A," and 5s. per share on 23,564 5s. "B." Mortgages and charges: £385,595.

New Phonopore Telephone Co., Ltd. (44,654).—This company's annual return was filed on November 5th, when 5,537 ordinary and 1,000 founders' shares had been taken up out of a nominal capital of £10,000 in 1,000 founders' and 9,000 ordinary shares of £1 each; £1 per share has been called up on 5,211 ordinary and 5s. per share on 326 (issued at 10s. per share premium), and £5,263 15s. has been received, leaving £28 10s. in arrears; £1,000 is considered as paid on 1,000 founders' shares. Mortgages and charges: £2,500.

A list of allotments filed November 12th shows that 660 ordinary shares were allotted between October 16th and November 12th, 15s. (of which 10s. is premium) being paid or payable on each. It is not clear whether these include the 326 shares above referred to, the latter having been issued since the date of the 1906 return.

Dewhurst's Engineering Co., Ltd. (73,205).—This company's annual return was filed on October 31st, when 2,000 preference and 1,007 ordinary shares had been taken up out of a nominal capital of £10,000 in 2,000 preference and 8,000 ordinary shares of £1 each; £1 per share has been called up and £3,007 has been received. Mortgages and charges: £7,500.

Nalder Bros. & Thompson, Ltd. (62,214).—This company's annual return was filed on October 21st, when 8,256 preference and 11,125 ordinary shares had been taken up out of a nominal capital of £22,500 in £1 shares (10,000 preference and 12,500 ordinary). £1 per share has been called up on 8,256 preference and 1,125 ordinary, resulting in the receipt of £9,381. £10,000 is considered as paid on 10,000 ordinary. Mortgages and charges: Nil.

Armstrong, Power & Co., Ltd. (Electrical engineers, London), (92,301).—A 10 per cent. debenture, dated October 30th, 1907, to secure £400, charged on the company's undertaking and property, including uncalled capital, has been registered. Holder: W. R. Peck, The Croft, Sutton, Surrey.

Whittaker Bros., Ltd. (67,858).—This company's annual return was filed on October 17th, when 3,907 shares had been taken up out of a nominal capital of £7,000 in 1,000 preference, 5,000 "A" ordinary and 1,000 "B" ordinary shares of £1 each. £3,207 has been received and £700 is considered as paid. Mortgages and charges; Nil.

Litholite, Ltd. (London) (93,441).—Particulars of £3,000 debentures, created by resolution of November 4th, 1907, have been filed pursuant to Sec. 14 (4) of the Companies' Act, 1900. Property charged, the company's undertaking and assets, present and future. No trustees.

Simms Manufacturing Co., Ltd. (magneto manufacturers, &c., Kilburn) (95,109).—£15,000 6 per cent. debentures, created November 1st, 1907, charged on the company's undertaking and property, present and future, including uncalled capital, have been registered. No trustees.

Pyrenees Electrical Society, Ltd. (94,225).—Particulars of £80,000 debentures, created by resolution of November 1st, 1907, have been filed pursuant to Sec. 14 (4) of the Companies' Act, 1900. Property charged, the company's undertaking and assets, present and future. No trustees.

Generators, Ltd. (81,816).—This company's annual return was filed on October 28th, when 1,807 shares had been taken up out of a nominal capital of £5,000 in £1 shares. £1 per share has been called up on 707, and 10s. per share on 100, resulting in the receipt of £757. 1,000 shares are considered as fully paid. Mortgages and charges: Nil.

S. Bornett & Co., Ltd. (89,565).—This company's annual return was filed on October 23rd, when 757 preference and 750 ordinary shares had been taken up out of a nominal capital of £2,000 in 1,000 preference and 1,000 ordinary shares of £1 each; £757 has been paid on the preference and £750 is considered as paid on the ordinary. Mortgages and charges: Nil.

North Wales Power and Traction Co., Ltd. (78,193).—Memoranda of satisfaction (*a*) to the extent of £70,000 of a security dated August 15th, 1905, covering £110,000, and other moneys, (*b*) to the extent of £70,000 of debenture stock covered by a trust deed of same date, securing £150,000, and (*c*) in full of a charge dated October 16th, 1905, securing £30,000, have been filed.

Hove and Worthing Electric Tramways, Ltd. (80,239).—This company's annual return was filed on November 30th, when 9 shares had been taken up out of a nominal capital of £100,000 in £5 shares. £45 has been received. Mortgages and charges: Nil.

CITY NOTES.

Isle of Thanet Electric Tramways and Lighting Co., Ltd.

The ordinary general meeting of the shareholders of this company was held on Thursday of last week at Winchester House, Old Broad Street, Lord Arthur Butler, the chairman, presiding.

In moving the adoption of the report (see Electrical Review, November 29th, page 905), the Chairman said that the assets had been increased by £1,912, the cost of installing a gas generating plant of 100-kw. capacity, while additional cables and house connections for electric light extensions during the year had cost £452. Dealing with the revenue account, it would be seen that the traffic receipts had decreased by £336, and they might consider themselves very fortunate that they did not suffer a much greater loss under

this head, taking into consideration the very inclement weather experienced during the period of the year on which they counted for making their largest receipts, particularly during the months of July and August. September improved matters very considerably, but the loss of traffic at Thanet in a wet July and August could not be compensated even by a fine September. It was a matter of regret to the directors to find that notwithstanding the excellent tram service which was maintained throughout the busy season, the traffic receipts were practically stagnant, and they were considering whether a small increase in fares during the busiest months would be desirable. While the traffic receipts were unsatisfactory, he was glad to say the sale of electricity showed a steady improvement, amounting to an increase of £700, or more than 20 per cent. advance upon the receipts of the previous year. The total connections at the close of the financial year were equal to 21,048 8-c.p. lamps, as against 18,640 in 1906, and 13,800 in 1905. Lighting revenue, under energetic management was always progressive, and in combination with traction business could be profitably carried on. They had considerable hopes from this source of revenue in future, but there was one feature connected with it which required attention, viz., the necessity of providing an extension of the mains, and for additional plant at the generating station to meet the increased load. Expenditure under these two heads would have to be faced from time to time, but the investment was sure to be attended with substantial profits where the lighting business was capable of being developed. Turning to the expenditure under the head of general expenses, there was an increase of £147 in traffic and general wages, which was accounted for by the increase in car-mileage, this being 756,201 miles in 1907, against 749,261 miles in 1906. The results of the power station operation had been very satisfactory, for although they sold electric current bringing in £700 more revenue than in 1906, and supplied electricity for 7,000 more car-miles, the total cost of generation was a trifle less than in 1906. There had been a saving of over £600 in the rolling stock maintenance, but some £400 additional was spent for improving and maintaining the machinery, which had helped them to keep down the cost at the generating station. The net results of the operations for the year left a balance at profit of £13,428, being an improvement of £479 on the previous year. After deducting the debenture interest, interest on loans, and the fee to the trustees for the debenture-holders, there remained a balance of £4,706 3s. 2d., and adding to this £376 17s. 1d. brought forward from last year, there was a sum amounting to £5,083 0s. 3d., with which they had now to deal. There were, however, two serious items standing against this revenue account which had also to be dealt with, viz., a balance of £1,200 on the suspense account for the reconstruction of the bogie cars, which was affected six years ago, and £2,019 for the reconstruction of the tramways on the Madeira Road, which was carried out last year. The road on this hill had been originally constructed to meet the requirement of the local authority, who objected to any material change in the levels of the roadways, but after a serious accident the Board of Trade intervened, and with the consent of the local authority the present reconstructed line had been laid. After careful and anxious thought, the directors had come to the conclusion that it was in the best interests of the shareholders that these two items, viz., Madeira Road reconstruction, and car improvements, should not remain as a drag upon the future earnings of the company, and so they determined to get rid of these two suspense accounts, and thus clear the balance-sheet. This application of the profits involved the postponement of the preference dividend, and might seem a drastic measure, but he felt sure that it would add to the stability of the company, improve its credit, and thereby assist them in placing some of their own debentures on better terms than they otherwise could, and hasten the date at which the full preference dividend could be paid again. Of the remaining balance they proposed to place £1,000 to reserve and carry forward £863 to the next account. They had been able to renew the third party insurance at a considerably reduced premium. They were paying for the current year only £1,400, against £1,830 last year, and if they got through next year without any serious accident, they expected to cover this risk on still better terms.

Mr. William M. Murphy seconded the motion.

Some discussion ensued, in which it was suggested by several shareholders that it would be a saving if the company acted as its own insurer.

The Chairman, in reply, pointed out that the whole question of insurance was gone into very fully at the last meeting, but it was felt that it would be too risky a thing to undertake.

The report was then adopted.

The Provincial Tramways Co., Ltd.

The 50th ordinary general meeting of the shareholders of this company was held on Friday last at the office, Moorgate Station Chambers, Mr. Andrew Beattie, J.P., D.L., in the chair.

The Chairman, in proposing the adoption of the report (see Electrical Review, November 29th, p. 905), said he was pleased to say that in the whole history of the company they had never had a better year than the one covered by the present accounts. Although the earlier part of the year was wet and unfavourable for traffic they had received profits from the local companies amounting to £38,048. That was highly satisfactory, being an increase of £7,055, or nearly 22 per cent. over the previous year, while, if they compared last year with 1905 when the receipts were £24,050, it showed an increase of £13,998 equal to about 29 per cent. Those large figures were rather surprising, especially in an old tramway like theirs, which was one of the oldest in the kingdom. They were going on surely and steadily. It was the opinion of some of their friends a year ago that they had reached the high water mark of their prosperity, but that would not seem to be the case, and this year since October 1st down to the present time, their receipts had shown an increase of £450 over the corresponding period in 1906. Those results had only been arrived at by close attention to the details of the working and good management. Last year the report stated that in order to discharge the liabilities upon capital account the directors had created £150,000 of first debentures to bear interest at 4½ per cent. per annum. When they made that announcement they thought that the debentures could easily be issued at 4½ per cent., but owing to the financial conditions which had existed they had found that impossible. They had, therefore, cancelled the proposed issue, and had created £175,000 5 per cent. first debenture stock which it was proposed to issue at par. The issue was being underwritten, but arrangements had been made by which applications from the shareholders would be preferentially considered. The debentures would be a first rate security. They would be a first charge upon the assets of the company both present and future, and the assets were nearly three times the amount they were going to borrow; while the earning powers were more than four times sufficient to pay the interest. The company was in a very healthy financial position. In addition to writing off large sums from time to time they were keeping the lines, &c., in a thorough state of order, so that the reserve fund would be a real help when their leases came to an end. The present dividend was equal to 4 per cent. per annum, and he had every hope that it would be maintained next year.

Mr. S. Hern seconded the motion, and the report was adopted.

Aron Electricity Meter, Ltd.

The directors' report for the year ended September 30th, 1907, shows, after providing for general charges and depreciation, a net profit of £20,052, making, with the balance carried forward from last year of £6,417, a total available profit of £26 469. Out of this amount the directors distributed in April last a dividend of 3 per cent. on the preference shares, absorbing £3,747, leaving £22,722 to be disposed of. The directors recommend the payment of a further dividend of 6 per cent. on the preference shares amounting to £7,494, and a transfer to a reserve towards goodwill and patents of £9,000, leaving to be carried forward £6,228. The directors are pleased to record a satisfactory progress of trade in all the company's branches. The factories continue to be fully employed, and have again been added to in order to cope with the increased business. For the greater convenience of the business of the company, the directors propose in future to close the annual accounts on March 31st in each year, instead of September 30th, as hitherto. The next financial period will, therefore, be for six months only, ending March 31st, 1908. The question of outstanding dividends due to preference shareholders has again had the careful consideration of the board, who hope to further reduce the arrears by a distribution after stocktaking on March 31st next, provided business continues as at present.

The Electromobile Co., Ltd.

From a report that has been supplied to us, we learn that at the annual meeting of this company held at 7, Hertford Street, on November 29th, the Chairman (Mr. Ernest Schenk) referred to the prosperity of the company, in spite of generally adverse circumstances in the shape of wide-spread financial depression, and then dealt with the closing of the hiring branch of the company in Paris. He said that whereas the London Hiring Co., in which the Electromobile Co. had a very large interest, had returned to its shareholders 50 per cent. in less than three years, the Paris business had only just paid its expenses. The reason for the success in London compared with Paris was not difficult to explain. While the cost of electricity had been reduced in London to 1d. a unit, it had remained in Paris at 4d., and, whatever could occur in the future, it was, in the directors' opinion, impossible so long as power remained at such a figure to run electric carriages profitably. The direct consequence of the difference in price was to increase the cost per mile by ¾d. They were in the fortunate position to-day of buying current in London at 1d. a unit, but they had even a further reduction to look forward to when the power supply companies realised that in the electric vehicle they had an ideal consumer which would take power when they most wished to supply it, and which would consequently help them to equalise their load throughout the entire day. They might look forward with confidence to even lower rates—rates at which it would pay to run vehicles in open competition with any form of public service vehicle. The accumulator car was from every point of view the ideal town car—for omnibuses, cabs and delivery vans. There was little doubt that if public opinion could speak, it would make itself heard in no uncertain terms as to its appreciation of a vehicle which was both noiseless and odourless. In regard to the company's intention concerning electric cabs for London, Mr. Schenk said that their data and results over a period of years were now sufficiently conclusive to enable the electric power supply companies to realise what a valuable new field was open to them by the introduction of the electric public service vehicle on the streets of London, and he did not think he was anticipating very far in expressing the opinion that power would soon be available for this purpose on a large scale at ½d. a unit. When he told them that

1 unit would propel a cab for 3 miles, and that the life of such a cab was calculated to be at least two or three times that of any of the present types of petrol machines, there could not be much doubt as to the success of the electric cab. In their opinion, the time was now ripe to place cabs on the street, and if the power companies could supply power at ½d. a unit, they knew that they could operate the cabs at a profit and more than hold their own against any known form of competition.

The Singapore Electric Tramways, Ltd.

The meeting of this company was held on Tuesday at the offices, 19, St. Swithin Lane, Sir Frank A. Swettenham, K.C.M.G., in the chair.

In proposing the adoption of the report (see Electrical Review, November 29th, page 905), the Chairman said that although the company was incorporated in March, 1905, the five sections of the tramways at present in use were not passed by the authorities and certified for traffic until September of that year, except in the case of one section only, which was opened on July 24th, 1905. The report was the first that had been presented by the board direct, but they had had the advantage of receiving considerable information in regard to the progress of the undertaking from the East India Construction Syndicate, in which most, if not all, of them were shareholders. The percentages only brought them down to December 31st, 1906, and the net result, which showed a loss of £7,623, could not be regarded as any indication of the future prospects of the company. It must be borne in mind that for some months after the opening of the tramways, traffic receipts were exceedingly low; that considerable expenditure, out of proportion to revenue, was incurred in the early days in training the native staff, and that a large undertaking of this kind could not be expected, immediately it was set in operation, to be earning a profit on £75,000, and they thought it was satisfactory that the traffic receipts had already so increased that the payment of interest on the £350,000 debentures was well assured. The board had deemed it desirable to write off to depreciation £7,304, in respect of rails and accessories, underground feeders, car bodies and trucks. In considering the possibilities of the undertaking, they must remember that they had an important section of the tramway still incomplete. That was known as No. 6, and would run from a point near the Tank Road station of the Singapore-Kranji Railway down to the mouth of the Singapore River. The completion of the undertaking had been delayed from several causes. He was not able to say when the section would be opened, but they were pushing on with the work from its northern end down to the Dalhousie monument, about 200 yd. from the approach to a bridge that was proposed to be built. When they got to this point they would perforce have to wait until the bridge was ready to receive their rails, and they were told that the bridge should be completed by the end of 1908. As soon as the track was completed to the Dalhousie monument, they intended to put cars on the section, and considerable extra revenue was looked for from that portion of the system. They had to bear in mind that they had a lively competitor in the ricksha service. There was evidence, however, to show that that traffic was not increasing, and no doubt it would gradually take the useful position of a feeder to their system. Recently they had been running the cars practically up to full strength. They were, therefore, shipping out six new cars this month, and had decided to add four others very shortly. They had decided to reduce the fares to a uniform one of 3 cents, their former fares being too high. Under the Tramway Ordinance provision was made for the supply of energy to the municipality of Singapore for lighting and power. The rates fixed by the Ordinance provided that the company should supply energy to the municipality's mains at 18 cents per unit with a discount of 25 per cent. off energy supplied for power. The municipality had the right to charge consumers 40 cents per unit. Before, however, commencing the supply, they agreed with the municipality that if it reduced its charge to the public to 25 cents, they would reduce their charge to 12·50 cents, still allowing 25 per cent. discount in the case of energy supplied for power. The Ordinance provided for the municipality to take a minimum of 100,000 units per annum for lighting. As in their case, the demand for tramway accommodation had to be created, so in the case of the municipality the demand for electric current had grown slowly, and for some months the municipality did not take their minimum average. He was pleased, however, to report that the monthly progress was steady and consistent, and for some little time now the municipal demand had been in excess of the minimum, and they saw no reason why, when the people of Singapore realised the benefits to be derived from electric lighting, the municipal demand should not largely increase. With regard to the revenue and expenditure, he had taken out three periods—one of eight months and two of nine months—from July 24th, 1905, to April 30th, 1906; from May 1st, 1906, to December 31st, and from January 1st, 1907, to August 31st. The figures worked out as follows:—

	1st	2nd	3rd
Revenue	£24,263	£34,590	£40,267
Expenses	20,213	21,536	21,506
Passengers	3,331,579	7,595,254	8,969,297
Ratio of expenses and revenue	83·31 %	62·25 %	53·41 %

These figures showed that the percentage of increase in the number of passengers carried was greater than the percentage of increase in receipts, which was attributable to the reduction in fares. It was gratifying to note that while the receipts for the second and third periods showed such satisfactory increases, the total expenses in each of these periods were very little higher than in the first period when the receipts were so low. The passengers carried per car-mile worked out at 3·06, 6·49, and 7·12 respectively. Here also there was a substantial increase. The earnings per car-mile in the three periods stood at 5·34d., 6·83d., and 7·48d., and it was satisfactory to note that the expenses per car-mile had steadily gone down from 4·45d. to 4·38d., and for the third period to 4·03d. The average fare per passenger for the first period (before reduction of fares) was 1·72d. During the last two periods it had stood at 1·03d. The average weekly receipts over the three periods were £580, £940 and £1,117. As he had referred to the supply of energy to the municipality, he would give them the figures for the two periods from May to December of last year, and January to August 31st of this year; they showed 35,755 and 58,427 units respectively, or a monthly average of 4,469 for the first period and 7,303 for the second period; the last four months (May to August) being 9,305, 9,127, 10,869 and 12,813. The last figure showed an excess of 54 per cent. of units above the minimum.

Sir Charles Petrie seconded the motion, which, after a short discussion, was adopted.

Rubber Plantations Co., Ltd.

At the meeting of this company held in London last week, the chairman, Mr. R. Hoffmann, made the following remarks concerning their rubber trees and present rubber prices:—"The number of rubber trees we are able to tap so far is only small, but nothing can stop these trees growing, and nothing will stop the larger returns coming in as the trees grow older and larger. The difference between the yield of a young tree and an old one is immense. The reason is that one is very chary of cutting a small tree too hard; you are liable to damage its future life. Therefore, one keeps one's trees in good health by gentle tapping in the early stages. That gentle tapping is done with great care, because if we were to force our trees in the early stages, they might, and probably would, gib when they grew older. Therefore when the trees are older, I think we may look forward to very large profits. You will notice we planted 80,000 trees in 1906 and 153,000 in 1907. These will take another five years before they are in bearing, and then our very large profit will commence. I still say very large profit, although some of you may be aware that the price of the raw article has fallen considerably during the last few months. This has been mainly caused by the financial troubles in America; but I am not going to put forward, as a great many do, that when once a fall takes place that fall is inevitably regained during the next few months. . . . . Do not let us look forward to either an abnormal rise or an abnormal fall as regards rubber. Let us assume, for instance, that it may even go a little lower than the very low price at which it stands at the present moment. What, then, will be our position? The present price of plantation rubber is 3s. 3d. per pound. . . . . Let us say we can only get 2s. 6d. per pound profit. At the ridiculously low figure of 1½ lb. per tree that yield would give us about 4s. per tree return. Therefore you may safely say that eventually, from what we have already planted—without taking into account what we may still plant in the next year or two—upon the report we are to-day presenting to you, the very least that must come from the rubber we have so far planted is £50,000 a year, when the trees have matured."

Companies Struck Off the Register.—The following companies have just been struck off the register, and are accordingly dissolved:—

Bridge Accumulator Syndicate, Ltd.
Burnand Transformer Co., Ltd.
Crown Electric Heating Syndicate, Ltd.
Finchley Electric Light Co., Ltd.
Folkestone District Electric Light and Power Co., Ltd.
Medical Electro-Vibration Institute, Ltd.
Paddington Electric Supply Co., Ltd.
Paragon Gauge Glass Protector, Ltd.
Rand Electric Syndicate, Ltd.
Rapid Transit Co., Ltd.
Thames Electric and Motor-Boats, Ltd.
Vaughan, Brown & Co., Ltd.

Prospectus.—*The County of London Electric Supply Co., Ltd.*—This company is stated to have made an issue of 15,000 £10 preference shares of 6 per cent., at par.

France.—The report of La Société Industrielle des Telephones, of Paris, for the last financial year shows a profit of £71,128, as compared with £64,132 in the preceding 12 months.

Richard Hornsby & Sons, Ltd.—In their report for the year ended September 30th the directors show a profit of £48,528, after writing off depreciation. After providing for debenture interest and preference dividend, the directors recommend a dividend on 5,545 new shares at the rate of 6¼ per cent. per annum and a dividend on ordinary shares at the rate of 6¼ per cent. per annum, less income-tax; £10,000 is placed to reserve account, £2,500 is written off patents, and £1,660 is carried forward.

Canadian General Electric Co.—This company has declared its usual quarterly dividend of 2¼ per cent., payable on January 1st.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	£*	No. of wks.	Total to date. £	£*	Route miles open.	Inc.
Aberdeen	Nov. 27	2,369	+ 28	26	38,054	— 1,506	14·4	..
Ayr	,, 30	359	+ 20	30	9,990	— 158	8	..
Bath	,, 30	1,213	— 131	48	37,162	— 1,733	13	..
Belfast	,, 29	6,851	+ 143	35	129,503	+ 8,458	36	..
Birkenhead	Dec. 1	2,088	+ 137	34	37,580	— 34	13·52	..
Birmingham Corp.	Nov. 23	12,500	..	34	202,578	..	56·46	..
†Blackburn	,, 27	961	— 17	35½	39,991	+ 2,618	14·13	..
Blackpool Corp.	,, 28	668	+ 17	..	46,326	— 1,316	11·87	..
,, —Fleetw'd.	,, 30	421	+ 25	21	22,270	— 990	8·25	..
Bolton	Dec. 1	4,123	+ 99	35	80,482	+ 4,848	26	..
Bournemouth	Nov. 27	2,533	+ 15	34½	62,007	+ 1,085	21·5	2½
†Bradford	,, 23	4,114	— 33	34	160,167	+ 3,129	54	1
Brighton	Dec. 1	1,364	— 111	35	33,553	— 3,017	9·5	..
Bristol	Nov. 29	10,127	— 293	..	..	..	28·5	..
Brit. Elec. Trac. Co.								
Airdrie	,, 22	464	+ 30	46	10,440	+ 32	3·65	..
Barnsley	,, 22	310	+ 43	,,	7,806	+ 189	..	..
Barrow	,, 22	468	— 17	,,	12,026	— 224	5·87	..
Cavehill	,, 22	123	+ 26	,,	3,966	— 238	..	..
Devonport	,, 22	825	..	,,	21,363	— 256	8·85	..
Gateshead	,, 22	3,000	+ 81	,,	46,885	+ 1,238	11·25	..
Gravesend	,, 22	490	+ 12	,,	11,454	— 5	6·5	..
Greenock	,, 22	1,090	+ 126	,,	30,586	— 467	7·25	..
Hartlepool	,, 22	495	— 15	,,	13,583	— 636	6·72	..
Kidderminster	,, 22	189	+ 12	,,	5,598	— 92	..	..
Leamington	,, 22	311	+ 18	,,	7,640	— 604	2	..
Merthyr	,, 22	1,420	+ 36	,,	9,829	+ 508	2·9	..
Metropolitan	,, 22	8,882	+2,726	,,	217,444	+56,207	22	..
Middleton	,, 22	624	+ 52	,,	16,508	— 48	8·5	..
Mid. Joint Com'tee	,, 22	11,544	+ 294	,,	272,254	+ 4,296	..	..
Oldham—Ashton	,, 22	1,135	+ 45	,,	28,195	+ 1,298	9·18	..
Peterborough	,, 22	213	+ 18	,,	5,282	— 158	5·31	..
Potteries	,, 22	3 918	+ 135	,,	87,778	+ 2,562	29	..
Rothesay	,, 22	83	— 2	,,	10,204	— 557	2·75	..
Southport	,, 22	448	+ 6	,,	13,998	— 652	8·17	..
S. Metropolitan	,, 22	1,410	..	,,	37,465	..	..	..
Swansea	,, 22	1,698	+ 61	,,	42,932	+ 3,121	5·5	..
Tynemouth	,, 22	299	— 2	,,	11,408	— 764	3·75	..
Weston-s-Mare	,, 20	63	+ 6	,,	6,977	— 375	3	..
‡Worcester	,, 22	462	+ 15	,,	13,275	— 160	5·75	..
Wrexham	,, 22	187	+ 7	,,	4,794	— 74	..	..
Yorks. Wool. Dist.	,, 22	1,670	— 24	,,	43,461	+ 852	17	..
Miscellaneous	,, 22	389	— 1	,,	10,428	— 185	..	..
Burnley	,, 30	2,307	+ 118	,,	..	..	7·5	..
Burton-on-Trent	Dec. 1	477	— 33	35	10,184	— 500	11	1·5
Bury	Nov. 24	2,139	+ 845	34	38,598	+ 4,331	10·5	..
Cardiff	,, 23	3,892	+ 162	34	74,410	— 2,038	15·87	..
Carlisle	,, 30	306	— 9	48	8,397	— 543	..	..
Chatham and Dist.	,, 28	1,204	— 46	48	34,606	+ 1,270	12·6	·68
Cork	,, 29	785	— 39	48	22,259	— 844	9·89	..
Croydon	,, 29	2,472	— 59	35	50,440	— 2,008	12	·75
Darlington	,, 30	427	+ 18	35	7,522	— 22	..	..
Darwen	,, 30	468	— 18	35	9,020	— 35	4·36	..
Dover	,, 23	320	— 53	34	8,191	— 1,095	4·75	..
Dublin	,, 29	9,330	+ 18	..	147,919	+30,856	54·25	5·5
Dundee	,, 27	2,185	+ 119	27	33,389	+ 941	13	..
East Ham	,, 30	1,428	+ 61	35	32,214	— 44	7·75	..
Exeter	,, 29	267	— 49	35	11,268	+ 574	4·75	·5
Glasgow	,, 30	33,389	+ 192	25½	461,548	+12,798	89·75	5·5
Hastings	,, 28	1,489	..	..	..	..	..	..
†Huddersfield	,, 23	1,474	— 1	34	55,011	+ 2,633	28	..
Hull	,, 30	5,062	+ 497	35	86,353	+ 4,684	13	..
Ilkeston	,, 27	256	+ 19	35	5,110	+ 274	3·5	..
Ipswich	,, 50	619	— 29	35	14,656	— 1,107	10·5	..
Isle of Thanet	,, 30	491	+ 43	48	31,196	— 250	11	..
Kilmarnock	,, 30	289	— 2	27	4,568	— 107	4·25	..
Lan'kshire Trm Co.	,, 28	2,417	+ 697	48	57,781	+15,250	15·82	3·26
Lancashire United	,, 27	2,270	+ 243	48	59,791	+13 859	39	1
Leeds	,, 23	12,342	+ 377	34	224,717	+ 9,482	51·13	3
Leicester	,, 30	4,125	— 60	..	..	..	..	..
Leith	,, 28	930	— 14	27½	14,836	+ 28	6	..
Liverpool	,, 23	30,981	— 33	47	514,218	+ 8,070	104	..
††L.C.C.	,, 16	30,297	+5,497	33	1,041,691	+175,029	116·5	10
London United	,, 29	10,547	+ 136		311,190	+13,184	..	..
Lowestoft	,, 30	327	+ 21	9	1,606	— 22	3·5	..
Manchester	,, 30	26,959	+ 90	35	522,575	+35,816	86	11
Newcastle	,, 30	7,882	— 163	35	144,114	+ 519	..	..
Newport	,, 23	1,225	+ 68	34	23,855	+ 1,331	14·5	..
Northampton	,, 29	737	+ 39	34½	15,391	— 456	5·5	..
Oldham	Dec. 1	3 645	+ 177	37	68,586	+ 4,349	23·75	..
Pontypridd	Nov. 30	642	+ 235	35	9,432	+ 3,512	5	1·75
Portsmouth	,, 30	2,962	+ 21	35	72,137	— 1,599	14·5	..
†Preston	,, 27	1,367	+ 35	..	..	..	..	..
Reading	,, 28	1,113	— 50	34½	21,857	— 801	13·25	..
Rotherham	,, 28	1,142	+ 164	34½	21,215	+ 3,465	10	·66
Salford	,, 25	8,916	+ 139	34	160,868	+ 4,405	38·9	..
†Sheffield	,, 24	5,347	— 4	35	195,556	+ 9,133	35·75	..
Southampton	,, 27	1,850	+ 121	34½	33,440	+ 1,740	..	..
Southend-on-Sea	,, 27	516	+ 7	35	15,208	— 54	..	..
Sunderland	Dec. 1	2,319	— 221	35	49,280	— 991	..	..
†Swindon	Nov. 20	141	— 4	..	..	..	4·4	..
Tyneside	,, 27	752	— 25	48	22,146	+ 921	8·87	..
Wallasey	,, 30	1,401	— 85	35	30,091	+ 705	8·72	·22
Walthamstow	,, 30	958	+ 106	35	21,979	+ 451	9	..
West Ham	,, 28	4,161	+ 13	35	81,570	+ 1,464	14·7	..
Wolverhampton	,, 27	1,545	+ 10	34	32,833	+ 232	12·5	..
Yorks. W. Riding	Dec. 1	2 050	— 70	48	55,840	..	..	..
Baker St.-Waterloo	Nov. 30	5,656	+1,610	22	54,065	+19,153	4·25	1
Cen. London Rly.	,, 30	11,831	—1,659	22	114.368	—17,613	6	..
Char. +, Ens. Hamp.	,, 30	5,780	..	22	57,775	..	7·75	..
City & S. Lon. Rly.	Dec. 1	6,884	+ 954	22	68 459	+ 9,787	7·3	1·05
Dublin-Lucan Rly.	Nov. 29	177	— 15	22	3,023	+ 266	7	..
G.N. and City Rly.	,, 30	3,699	— 70	22	36,762	— 787	3·5	..
G.N., P'dy. & Brmp.	,, 20	2 815	..	22	22,795	..	2	..
L'pool Overh'd Rly.	Dec. 1	2,721	— 67	22	34,459	+ 1,717	6·8	4·3
Mersey Railway	Nov. 30	3 870	+ 259	22	40,566	+ 2,943	4·5	..
Metropolitan Rly.	Dec. 1	31,063	+ 165	23	330 841	+ 6,128	24·6	..
Met. District Rly.	Nov. 30	17,141	+ 802	22	169,548	— 29	24	..
Anglo-Argentine	Dec. 2	36,898	+2,769	48	805,887	+76,192	48	..
§Auckland	Nov. 8	10,674	+ 946	44½	114.568	+ 5,001	19·2	·66
§Brisbane	Nov.	13,570	+1,794	..	..	..	..	..
§Brit. Columbia Rly.	October	36,499	+10,964	17½	130,633	+37,121	6·8	4·3
Calcutta	Nov. 30	6,638	— 51	..	..	..	..	..
§Cape Electric T. Ld.	August	9,240	..	..	..	..	..	..
§Geneva	October	8 557	+ 426	..	..	..	..	..
§Kalgoorlie, W.A.	,,	3,968	..	43	39,925	..	20·5	..
Madras	Nov. 30	1.080	+ 149	48	25,308	+ 4,166	12·75	·5
§Lisbon	October	7,970	..	..	..	..	..	..
Perth (W.A.)	Nov. 29	2.707	— 53	48	67,232	— 2.067	25·48	·32
†Buenos A. & Belgro.	,, 25	8,057	+ 505	42	181,482	+10,055	..	..

* Compared with the corresponding period of 1906. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Evening.

FINANCIAL conditions in the United States continue to improve, and there is a prospect of early reduction in our Bank Rate on this side. Therefore, prices have picked up heart of grace—as well as something more substantial in the way of improvement—and the year bids fair to wind up with subdued cheerfulness after all. Yet, in looking over the lists of quotations to-day, as compared with those of last December, the shrinkage is something distressing.

This week it is the Home Railway market which stands out prominently, on account of the working agreement between the Great Northern and the Great Central encouraging hopes of further developments by other companies in the same direction. It has taken several years of adversity to bring the railway companies round to the view that common-sense is, after all, a rather necessary factor in management of their affairs, but better late than never. How the railways would have fared during the last half-decade had trade been bad, it would require a Socialist to really appreciate.

Central London Ordinary stock has risen 5 to 62½, as a direct outcome of the public demand for Home Railway stocks, coupled, of course, with the hope that the company will do better now that the omnibus competition is to be somewhat mitigated. District Ordinary hardened to 9¼; Metropolitan Consolidated at 38 has been advanced. Other London railway stocks show little change.

Traction issues are not very firm. British Electric Ordinary and Preference have gained ¼ each, but the second Debenture stock slipped back a point. The South American varieties kept firm, while Calcutta Trams went 2s. 6d. lower.

Underground Electric profit-sharing notes went on falling until Messrs. Speyer Bros. announced that the firm would cash the coupon due this week. Upon this eleemosynary assistance, the price of the Notes recovered to 37, *ex* the coupon of 2½ per cent. What will be done next, it remains for Messrs. Speyers to unfold, but a cut-and-dried scheme is said to be practically ready for placing in front of proprietors.

Charing Cross Preferences have both spurted to 4, and the shares are being recommended by some brokers as good investments. At the round figure, which is £1 a share discount, the return upon the money works out to 5⅝ per cent., and in more normal times there should be a rise in capital value. City of London Electric Lighting Preference are 10s. higher at 11¼, and County of London have not altered upon the offer of new Preference shares at par to the present proprietors of the senior issue. Folkestone Electrics are a little lower. Movements in the various Debenture stocks have been limited.

Electric Construction Ordinary shares nearly doubled their price in rising to 4s. 4½d. upon a small speculative demand. Henley's Debenture stock has recovered part of the deducted interest, and Castner-Kellner shares, falling 1/16 to 1¼ *ex* dividend, are virtually unaltered, the distribution being 1s. 7½d. per share. British Aluminium Preference and Funding certificates both gave way. There is an idea that the last issue of capital has not yet been comfortably placed.

Telegraph stocks present a lively list of advances. All the various groups participate in the improvement, which is due to the cheerfuller outlook in the financial world. The Anglo-American stocks derived support from the strength of American Railroad shares, and the cessation of liquidation of weak accounts. Moreover, an important improvement is being made in the Stock Exchange, whereby the Anglo-American Telegraph and the Commercial Cable Companies are allowed to send their messages into the House itself. Everything should be ready for full working order early in the New Year.

Eastern Telegraph stocks have risen appreciably upon investors' demands, and Eastern Extension shares are also firmer. Eastern Telegraphs added substantially to their previous gain, and even Marconi shares, at 15s., stand slightly higher. Rises in the Globe shares reflect the better feeling apparent in this department. Telephone descriptions are steady on the whole, although Oriental Preference eased off. National Telephone issues are better.

We are told that the public took 75 per cent. of the recent Mexican Light and Power Preference issue, but we are loth to think so lightly of the public's power of discrimination. Nor do we suppose there will be an eager response to the appeal of the Electrobus Company for more capital.

In its list of railway traffic returns, Tuesday's *Daily Mail* gravely reported one from the "City and Suburban." May be the City and South London Railway people smiled.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1903.	1904.	1905.	1906.	Closing Quotations Nov. 26th.	Closing Quotations Dec. 3rd.	Business done week ended Dec. 3rd, 1907. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	2⅛ — 3⅛	2⅛ — 3⅛	..	..	..	Nil
149,600	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	Nil	Nil	5 %	5 %	85 — 88	85 — 88	..	..	..	5 13 8
660,660	Anglo-American Telegraph	Stock	6½s.	2¾%	3½%	3¾%	54 — 57	55 — 58	55½	55	+1	6 13 7
3,169,670	Do. do. do. 6 % Pref.	Stock	6 %	5¾%	6 %	6 %	96 — 98	98½ —100½	99½	96¾	+2½	5 19 5
3,169,670	Do. do. do. Deferred	Stock	2s.	Nil	⅛%	1⅜%	14 — 14½	14⅞ — 15¼	15 5/16	14 1/16	+ ¼	11 9 6
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	..	..	5 %	5 %	99 —102	99 —102	99½	..	..	4 18 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	7 %	8 %	8 %	8 %	6⅝ — 7¼	6⅝ — 7¼	..	..	..	5 10 4
2,097,680	Commercial Cable Stlng. 500 year 4 % Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	83 — 87	84 — 87	84½	83¼	..	4 12 0
16,000	Cuba Telegraph	10	0 %	5 %	5 %	5 %	6 — 7	6 — 7	..	..	..	7 2 10
6,000	Do. 10 % Pref.	10	15 %	10 %	10 %	10 %	15 — 16	15 — 16	..	..	..	6 5 0
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3¼ — 3¾	3¼ — 3¾	..	..	..	5 14 3
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8¼ — 8⅝	8¼ — 8⅝	..	..	..	5 14 3
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	8 18 2
60,710	Direct United States Cable	20	3 %	3½%	4½%	4½%	13 — 13½	13⅛ — 13⅜	13 1/16	13⅛	+ ⅛	6 15 9
57,000	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	125 —130	128 —133	131	127	+3	5 5 8
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	80 — 83	82 — 85	85	81½	+2	4 2 4
1,896,705	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	98 —101	98½—101½	99½	98½	+ ½	3 18 10
300,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	7 %	12 — 12¼	12⅜ — 12⅝	12⅝	12⅜	+ ⅛	5 8 9
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	99 —102	99 —102	100	..	..	3 18 5
295,400	East & S. Afric. Tel., 4 % Mt. Db., 1 to 3,000, red. 1909	100	4 %	4 %	4 %	4 %	97⅜—100⅛	98 —101	..	..	+ ⅛	3 19 3
200,000	2 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	98 —100	98½—100½	..	..	+ ⅛	3 19 7
181,127	Globe Telegraph and Trust	10	5⅝%	5⅝%	5⅝%	5⅝%	9¼— 9⅝	9⅜— 10⅛	10	9⅛	+ ⅛	5 7 4
181,127	Do. do. 6 % Pref..	10	6 %	6 %	6 %	6 %	12⅛— 12⅝	12⅝— 13⅛	12⅞	12 9/16	+ ⅛	4 10 7
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	15 %	24 %	24%	20 %	30½— 32½	30½— 32½	..	..	..	6 3 1
28,900	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
17,000	Indo-European Telegraph	25	10 %	13 %	13 %	13 %	50 — 60	52 — 55	..	..	..	6 5 0
$41,380,400	Mackay Companies Common	$100	..	1 %	2 %	3½%	50 — 60	50 — 60	..	..	..	5 16 8
$50,000,000	Do. do. 4% Cum. Pref.	$100	..	4 %	4 %	4 %	50 — 60	50 — 60	..	..	..	6 13 4
256,127	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	⅜— ⅜	1⅛— 1⅜	13/16	..	+ 1/16	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	3 %	4 %	5 %	6 %	1⅜— 1⅝	1⅝— 1⅞	..	..	..	4 14 1
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	¾— 1	¾— 1	..	..	..	5 0 0
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	106 —108	106½—108½	107½	104¾	+ ½	5 10 7
2,225,000	Do. do. Def. Stock	100	5 %	5 %	5 %	5 %	103 —105	104½—106½	105½	103	+1½	4 13 11
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10½— 12½	10½— 12½	..	..	..	4 16 0
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	5 %	10 — 12	10 — 12	..	..	..	4 3 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅛— 5⅜	5⅛— 5⅜	5 5/8	5⅛	..	4 12 10
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	96 — 98	96½— 98½	97½	..	+ ½	3 11 1
1,689,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	98½—100½	99½—101½	100½	100	+1	3 18 10
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	6½%	6½%	7 %	7 %	1⅛— 1⅜	1⅛— 1⅜	..	..	..	5 14 0
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1⅛— 1⅜	1 1/16— 1 1/16	..	..	— 1/16	5 1 1
100,000	Do. do. do. 4 % Red. Deb. Stock ..	100	..	..	4 %	4 %	90 — 95	90 — 95	..	..	..	4 6 0
100,000	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	4 0 0
11,839	Reuter's	8	5 %	5 %	5 %	5 %	7 — 8	7 — 8	7⅞	..	..	5 0 0
60,000	Telephone Co. of Egypt, 4½ % Deb. Red.	100	..	..	4½%	4½%	98 —101	99 —102	100¼	100½	+1	4 8 3
3,167	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	124 —127	124 —127	..	..	..	4 14 6
80,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6⅝— 7⅛	6⅝— 7⅛	6 15/16	..	..	5 12 3
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	4⅛— 5⅛	4⅛— 5⅛	..	..	..	4 13 0
15,609	West African Telegraph, Shares	10	4 %	4½%	4 %	4 %	10 — 10⅛	10 — 10⅛	..	..	..	8 16 2
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2	Nil	Nil	Nil	2½%	1⅛— 1⅜	1⅛— 1⅜	25/-	..	..	3 12 9
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	4 0 0
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	7 %	12⅜— 12⅞	12⅝— 13⅛	13⅛	12⅝	+ ⅜	5 5 8
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	99½—101½	98½—101½	..	..	..	3 18 10
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	7/16— 7/8	7/16— 7/8	9/6	8/9	..	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	7 %†	6 %	5 %	8 %	7 — 7⅛ xd	7 — 7⅛	7⅛	7 1/16	..	10 13 4
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	Nil	6⅞— 7⅛	6⅞— 7⅛	..	..	+ ⅛	Nil
80,000	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	99 —102	99 —102	..	..	..	4 18 0

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

270,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,097	5	..	8 %	8 %	8 %	7½— 7⅝	7½— 7⅝	7 15/16	7½	..	5 3 3
260,007	Do. 6 % Cum. Prefs., 1 to 260,007 ..	5	5⅛%	5⅛%	5⅛%	5⅛%	5 1/16— 5 3/16	5⅛— 5⅞	..	..	..	4 14 7
266,600	Do. Permanent, 6 % Deb. Stock, 1888	100	6 %	6 %	6 %	6 %	128 —131	128 —131	..	..	..	4 11 7
285,100	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —105	102 —105	..	..	..	4 15 8
830,000	Babcock & Wilcox, 1 to 830,000..	1	17 %	20 %	20 %	20 %	3½— 3⅝	3½— 3⅝	74/4½	72/6	..	5 6 8
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 1/16— 1 3/16	1⅛— 1 1/16	..	..	..	3 16 10
88,000	British Aluminium, Ord., 2,001 to 40,000	5	..	7 %	7 %	7 %	4¼— 4⅜	4¼— 4⅜	80/-	76/3	— ⅛	7 15 7
40,000	Do. do. 7 % Cum. Pref.	5	Nil	7 %	7 %	7 %	4⅛— 5	4⅛— 5	..	..	— ⅛	7 0 0
20,000	Do. do. "A" 6 % Cum. Pref.	5	Nil	6 %	6 %	6 %	4⅛— 5	4⅛— 4⅝	..	..	— ⅛	6 6 4
30,000	Do. do. 4 % Funding Certs.	5	..	4 %	4 %	4 %	3⅝— 4⅛	3⅝— 4⅛	..	..	..	4 14 1
258,000	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	5 %	100 —103	100 —103	..	..	..	5 13 5
300,000	Do. do. 5½ % Loch Leven Debs. ..	100	..	..	..	5½%	96 — 99	94 — 97	96½	96	—2	5 11 1
400,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	6 %	6 %	128 —133	123 —128 xd	126	124½	..	4 10 3
300,000	Do. 5 % Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	110 —114	104 —109 xd	109½	..	..	4 7 9
300,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	99 —103	99 —103	..	..	..	4 17 1
238,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250 ..	40	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
133,301	British Electric Traction	10	6 %	6 %	3 %	Nil	1½— 1⅝	1½— 2	35/-	27/6	— ½	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	6 %	4¼— 4⅝	4¼— 5	98/9	88/9	..	12 0 0
1,448,653	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	92 — 95	92 — 95	94	93¾	..	5 5 3
410,178	Do. do. 4½ % 2nd Deb. Stock Red.	100	..	4½%	4½%	4½%	74 — 78	73 — 77	..	..	—1	5 16 1.
100,000	British Insulated and Helsby Cables	5	8 %	8 %	8 %	10 %	6¾— 7	6¾— 7	..	..	..	7 2 10
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	5⅝— 6⅛	5⅝— 6⅛	5⅝	..	..	4 18 0
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	101 —104	101 —104	103½	..	..	4 6 7
212,000	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	85 — 89	85 — 89	..	..	..	4 18 11
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	6 %	Nil	Nil	Nil	⅞— 1½	⅞— 1½	..	..	..	Nil
1,016,358	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	55 — 65	55 — 65	58	..	..	6 3 1
50,000	‡ Browett, Lindley & Co., Ord.	£1	Nil	Nil	Nil	..	9/16— 11/16	9/16— 11/16	..	..	..	Nil
50,000	‡ Do. do. 6 % Cum. Pref.	£1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
105,781	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	Nil	Nil	2½%	Nil	0— ½	0— ½	..	..	..	Nil
150,000	Do. do. Non-cum. 6 % Pref.	2	6 %	6 %	6 %	Nil	⅜— ⅝	⅜— ⅝	..	..	..	Nil
125,000	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	83 — 86	83 — 86	..	..	..	6 12 4
125,000	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	65 — 68	65 — 68	..	..	..	6 8 7
100,000	Buenos Ayres & Belgrano, 1 to 100,000	5	3 %	4 %	3 %	3 %	4⅜— 4⅝	4⅜— 4⅝	..	..	..	3 4 10
40,000	Do. do. "A" 6 % Cum. Pref., 1 to 40,000	5	6 %	6 %	6 %	6 %	4⅞— 5⅛	4⅞— 5⅛	..	..	..	5 14 3
27,500	Do. do. "B" do., 1 to 27,500	5	6 %	6 %	6 %	6 %	4⅞— 5⅛	4⅞— 5⅛	96/3	..	..	5 14 3
13,200	Do. do. 5 % Deb. Stock	100	5 %	5 %	5 %	5 %	105 —115	105 —115	..	..	..	4 6 11
190,000	Do. do. 5 % 2nd Deb. Stock	100	5 %	5 %	5 %	5 %	102 —105	102 —105	..	..	..	4 15 3
187,610	Calcutta Trams, 1 to 187,610	5	6 %	8 %	8 %	8 %	6⅝— 7⅛	6⅝— 6⅞	6 15/16	..	— ⅛	5 16 4
30,000	Do. 5 % Cum. Pref., Nos. 1 to 29,330..	5	..	..	5 %	5 %	5 — 5⅛	5 — 5⅛	5 1/16	..	..	4 10 11
350,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	100 —104	100 —104	..	..	..	4 6 7
35,000	Callender's Cable Construction shares	5	12½%	12½%	15 %	15 %	9½ — 10½	9½ — 10½	..	9 1/16	..	7 6 4
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5½— 5⅝	5½— 6	5⅝	..	+ ⅛	4 3 4
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105⅛—107⅛	105⅛—107⅛	..	..	..	4 3 4
491,222	Cape E Trams., 1 to 491,222	1	10 %	5 %	Nil	Nil	⅜— ⅝	⅜— ⅝	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	4 %	4 %	6 %	5 %	1⅛— 1⅜	1⅛— 1 3/16 xd	25/6	24/6	..	5 16 4
224,988	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4½%	98 —102	98 —102	100¼	..	..	4 8 3
911,568	Central London Railway, Ord. Stock..	Stock	4 %	4 %	4 %	4 %	57 — 60	62 — 65	65	59	+5	6 3 1
544,216	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	83 — 85	83 — 85	84½	..	..	4 14 2
544,216	Do. do. Def. do.	Stock	4 %	4 %	4 %	4 %	40 — 43	41 — 44	..	..	+1	9 10 6
1,480,000	City and South London Railway	Stock	2⅜%	2⅛%	1⅞%	2⅛%	43 — 45	43 — 45	44⅜	43⅜	..	4 14 5

* Unless otherwise stated, all shares are fully paid. † A period of nine months. ‡ From Manchester Share List.

(Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Nov. 28th.	Closing Quotations Dec. 3rd.	Business done week ended Dec. 3rd, 1907.		Rise + or Fall —	Present Yield per cent.
		*	1903.	1904.	1905.	1906.			Highest	Lowest.		£ s. d.
85,000	Crompton & Co., Nos. 1 to 85,000	3	2½%	2½%	2½%	5 %	1 2/16 — 1 3/16	1 2/16 — 1 3/16	31/3	..	..	8 6 8
100,000£	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	96 — 99	96 — 99	..	..	..	5 1 0
260,000	Dick, Kerr & Co., 1 to 260,000	1	..	10 %	10 %	10 %	1¼ — 1⅜	1⅛ — 1⅜	..	..	— 1/8	7 5 5
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1 — 1¼	1 — 1¼	..	..	..	4 16 0
294,150	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
60,000	Dublin United Trams. (1896), 1 to 60,000	10	5⅓%	6 %	6%	6 %	12⅜ — 13⅛	12⅜ — 13⅛	..	..	..	4 8 11
59,987	Do. 6 % Pref. between 1 and 60,000	10	6 %	6 %	6 %	6 %	12⅜ — 13⅛	12⅜ — 13⅛	..	..	..	4 7 3
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	Nil	2⅓%	4⅓%	4⅓%	1 2/16 — 1 3/16	1 2/16 — 1 3/16	..	..	..	11 15 0
17,189	Do. "A" shares, 01—017,189	5	Nil	2⅓%	4⅓%	4⅓%	1⅛ — 2⅛	1⅛ — 2⅛	..	..	..	8 6 9
319,475	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	79 — 82	79 — 82	..	..	..	4 17 7
72,220	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	87 — 90	87 — 90	..	..	..	5 11 1
112,100	Electric Contruction, 1 to 112,100	2	4 %	Nil	Nil	Nil	5/32 — 9/32	5/32 — 9/32	..	..	— 3/32	Nil
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	7 %	Nil	⅛ — 1	⅛ — 1	..	..	..	Nil
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	4 %	5 %	5 %	5 %	8 — 8½	8 — 8½	..	..	..	5 17 8
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	89 — 92	89 — 92	..	..	..	4 19 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	3 %	4 %	4 %	4 %	1 — 1⅛	1 — 1⅛	..	..	..	19 10 0
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	7 %	10½ — 10⅝	10½ — 10⅝	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103	102 —103	..	..	..	4 17 1
200,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15 %	15%	15 %	10½ — 11⅛	10½ — 11⅛	..	..	..	6 10 0
200,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 — 5⅛	5 — 5⅛	..	..	..	8 17 3
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	105⅛—107⅜	104 —106 xd	104	..	..	4 3 9
50,000	India-Rubber, Gutta-percha & Telegraph Works.	10	10%	5 %	10%	10 %	14⅛ — 15⅛	14⅛ — 15⅛	15	..	..	6 11 2
37,500	†Liverpool Overhead Railway, Ord.	10	1⅞%	1½%	Nil	Nil	1⅜ — 1⅝	1⅜ — 1⅝	..	..	— 1/8	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	7⅛ — 8	8 — 8½	..	..	..	5 17 8
600,070	London United Trams. (1901), 1 to 50,007	10	8 %	6 %	3 %	3 %	6¼ — 6⅜	6¼ — 6⅜	..	..	..	4 8 11
399,930	Do. do. 60,008 to 100,000	10	8 %	6 %	3 %	3 %	6¼ — 6⅜	6¼ — 6⅜	..	..	..	4 8 11
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	5 %	7⅛ — 8⅛	7⅛ — 8⅛	7 2/16	7⅛	..	6 1 3
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	82 — 86	81 — 86	83½	..	— ½	4 13 0
314,016	Metropolitan Electric Trams., Defd.	1	Nil	Nil	Nil	Nil	1/16 — 3/16	1/16 — 3/16	1/8	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	1/16 — 1/8	1/16 — 1/8	17/-	16/3	..	5 6 8
350,000	Do. do. 4½ % Deb. Stock Red.	100	..	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 13 9
245,500	Potteries E. Trc.	1	5 %	5 %	4 %	4 %	3/16 — 1/4	3/16 — 1/4	..	..	..	7 2 3
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	1/8 — 3/16	1/8 — 3/16	..	..	..	6 13 4
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	93 — 96 xd	93 — 96	..	..	..	4 13 9
37,350	Telegraph Construction and Maintenance	12	20 %	15 %	15 %	15 %	27½ — 29½	28 — 30	28 1/16	..	+ ½	5 18 0
150,000£	Do. 4 % Ded. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	99½—102½	100 —103	..	..	+ ½	3 17 8
599,200	Undergd. E. R., Lon., 5 % Profit Shar. S. Nts.	..	..	5 %	5 %	5 %	34 — 38	35 — 39 xd	35	..	..	13 3 2
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	3 %	Nil	Nil	..	⅜ — 1½	⅜ — 1½	..	..	..	Nil
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	5	6 %	Nil	Nil	..	3½ — 3¾	3½ — 3¾	..	..	..	Nil
246,574	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	74 — 79	72 — 75 xd	..	..	..	5 1 3

ELECTRICITY SUPPLY COMPANIES.

14,000	Bromley (Kent) E.L. & P,. 1 to 14,000	5	5 %	5⅓%	5⅓%	5⅓%	4⅝— 5⅛	4⅝— 5⅛	..	..	..	5 7 4
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	96 — 98	96 — 98	..	..	..	4 11 10
29,798	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10 %	10 %	10%	7 — 8	7 — 8	..	..	..	6 5 0
10,202	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7 — 8	7 — 8	..	..	..	4 7 6
336,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	98¾—101½	96 — 99	101¾	97	—1½	4 0 10
80,000	Charing Cross and Strand Electricity Supply	5	8 %	8 %	5 %	5 %	3 15/16 — 4⅛	3 15/16 — 4⅛	80/-	..	..	5 2 10
80,000	Do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	3⅜ — 3⅝	3⅜ — 4⅛	80/-	..	+ 3/32	5 5 11
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅜ — 3⅝	3⅜ — 4⅛	..	..	+ 3/32	5 5 11
427,400	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	4 0 0
49,436	Chelsea Electricity Supply, Ord.	5	5½%	6 %	6 %	4½%	3¾ — 4⅛	3¾ — 4⅛	75/-	..	..	5 5 11
175,000£	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	102 —105	102 —105	104	103½	..	4 5 9
70,595	City of Londo Elec, Lighting, Ord. 40,001—110,595	10	5 %	6 %	6 %	6 %	9½ — 10½	9½ — 10⅛	10½	10	..	5 17 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	10⅜ — 11⅛	10⅜ — 11⅛	11⅜	..	+ ⅛	5 2 2
400,000£	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	122 —125	122 —125	..	..	..	4 1 4
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	96	..	..	4 11 10
40,000	County of Durham Electrical Power, Ord.	5	4 %	£3 7 0	4 %	4 %	3½ — 4¼	3½ — 4¼	..	..	..	4 14 1
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	4⅜ — 4⅝	4⅜ — 4⅝	..	..	..	5 2 7
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4 %	4½%	5 %	5 %	6½ — 7⅛	6½ — 7⅛	7 1/16	..	..	6 13 4
40,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10 — 10⅜	10 — 10⅜	10⅜	10½	..	5 11 8
400,000£	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	105 —108	106 —109	..	..	+1	4 2 7
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	95 — 98	95 — 98	95½	..	..	4 11 10
80,000	Edmundson's Electric Corporation, Ord. Shares	5	7 %	7 %	4 %	Nil	⅜ — ⅞	⅜ — ⅞	..	..	..	11 0 0
80,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	3 %	1 — 1½	1 — 1½	22/6	..	..	8 11 5
360,000	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	76 — 81	76 — 81	..	..	..	5 11 1
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅜ — 5⅛	4⅜ — 5	..	..	— ⅛	5 10 0
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	..	..	5 %	5 %	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	4 13 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	..	..	..	4 10 11
13,000	Hove, 1 to 13,000	5	8½%	8½%	9 %	9 %	6½ — 7	6½ — 7	..	..	..	6 8 7
21,000	Kensington and Knightsbridge Electric Ord.	5	12½	12 %	10 %	10 %	8 — 9	8 — 9	..	..	..	5 11 1
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
111,000	London Electric Supply Corporation, Limited, Ord.	3	Nil	3 %	4 %	4 %	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..	6 16 2
70,000	Do. do. do. 6 % Pref.	5	6 %	6 %	6 %	6 %	3⅞ — 4⅛	3⅞ — 4⅛	..	..	..	7 1 2
874,395	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4 %	4⅓%	89 — 93	89 — 93	..	..	..	4 16 9
200,000	Metropolitan Electric Supply, 1 to 100,000	5	8⅜%	10 %	10 %	8 %	5⅛ — 5⅜	5⅛ — 5⅜	5⅜	..	..	6 19 2
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝ — 5	4⅝ — 5	96/3	..	..	4 10 0
220,000£	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	102 —106	102 —106	..	..	..	4 4 11
250,000£	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	86 — 91	86 — 89	..	..	..	3 16 11
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	96⅜ — 98⅝	96 — 99	..	..	+ ½	4 10 11
87,500	Newcastle-on-Tyne, 1 to 87,500.	5	8 %	8 %	8 %	8 %	6¼ — 6⅝	6⅛ — 6⅝	..	..	..	5 18 6
87,500	Do. 5 % Pref., 1 to 87,500	5	5 %	5 %	5 %	5 %	5 — 5⅛	5 — 5⅛	..	..	..	4 10 11
10,852	Notting Hill Electric Lighting	10	6 %	7 %	7½%	7½%	10½ — 11½	10½ — 11½	..	..	..	6 10 5
20,000	Oxford, 1 to 96 and 407 to 20,310	5	6⅔%	7 %	7 %	7 %	5⅝ — 6	5⅝ — 6	..	..	..	5 16 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 97	95 — 97	..	..	..	4 2 6
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14½%	14½%	12½%	10 %	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	6 1 8
20,000	Do. do. 7 % Pref. 20,061 to 40,060	5	7 %	7 %	7 %	7 %	6 — 7	6 — 7	..	..	..	5 0 0
150,000£	Do. do. 3½ % Deb. Stock Red.	100	3½%	3½%	3 %	3½%	86 — 91	86 — 91	..	..	..	3 16 11
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	4 %	4 %	Nil	⅜ — 1⅛	⅜ — 1⅛	..	..	..	Nil
60,000	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	71 — 75	71 — 76	..	..	+ ½	5 5 3
65,000	South London Electricity Supply, Ord.	5	3 %	4 %	4 %	3 %	2 — 2⅛	2 — 2⅛	..	..	..	6 0 0
120,000	South Met. Elec. Lt. & Power, Ord.	1	Nil	Nil	2½%	2½%	⅜ — ⅝	⅜ — ⅝	..	..	..	3 6 8
117,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 3/16 — 1 5/16	1 3/16 — 1 5/16	23/9	..	..	5 17 11
200,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	1⅜ — 2⅛	1⅜ — 2⅛	..	..	..	11 10 6
60,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1¼ — 2⅛	1⅛ — 2⅛	..	..	..	8 13 1
200,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	..	4½%	4½%	4½%	92 — 95	92 — 95	..	..	..	4 14 9
110,000	Westminster Electric Supply, Ord.	5	13⅓%	14 %	13 %	12 %	8 — 9	8 — 9	8¾	8½	..	6 13 4
81,279	Do. do. 4½ % Cum. Pref. (Original 5 %—Red. to 4½ % from 31st Dec., 1905)	5	5 %	5 %	5 %	4½%	4⅝ — 5⅛	4⅝ — 5⅛	95/7½	93/9	..	4 7 10

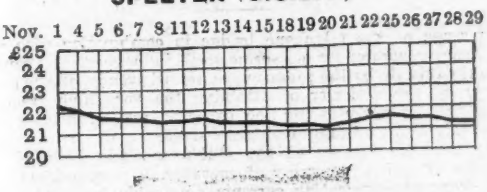
* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 7 per cent., November 7th, 1907.

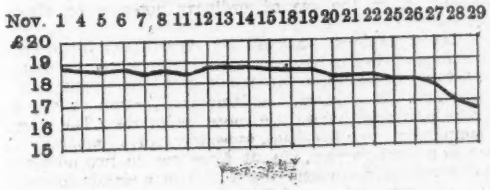
METAL MARKET.

Fluctuations in November.

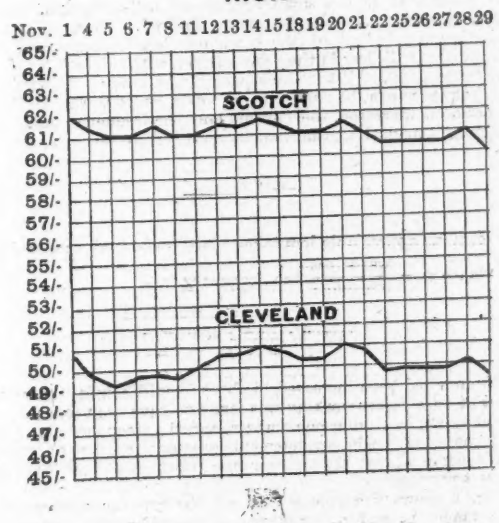
SPELTER (G.O.B's.).



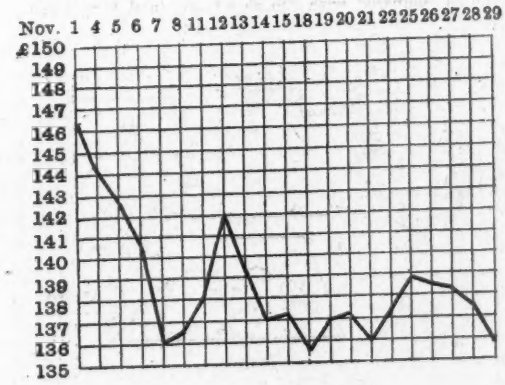
LEAD (ENGLISH).



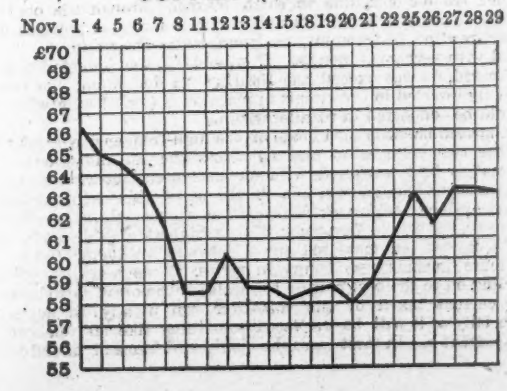
IRON.



TIN.



COPPER (G.M.B's.).



NEW ELECTRICAL SCHEMES TO COME BEFORE PARLIAMENT.

THE following is a list, arranged in our usual annual form, of the electric lighting, power, and tramway projects that are, according to present intentions, to be considered by Parliamentary Committees during the next session :—

I—Electric Lighting and Power Proposals.

Barton-upon-Irwell.—Application by the R.D. Council for amendment of 1906 order; extension of time and powers as to transfer to Lancashire Electric Power Co.

Bath.—Application by R.D. Council for amendment of 1904 order; extension of time and provisions for transfer.

Bridgend.—Order to U.D.C. extending and amending provisions of 1893 order; powers concerning supply to consumers having separate supply.

Caldy Manor.—Power to Caldy Manor Estate, Ltd., to supply electricity.

Draycott Gas Co.—Power to apply for provisional order to supply electrical energy.

Finchley U.D.C.—Extension of area to include portions of Friern Barnet; supply of energy in bulk outside the district and for traction purposes.

Fleetwood.—Provisional order for Broadstone, Ltd.

Fleetwood.—Supply powers to U.D.C.; revocation of 1890 order; annulment of transfer to Fleetwood and District E.L. and P. Syndicate.

Great Eastern Railway (General Powers).—Power to supply from Parkeston or elsewhere and charge for electricity; agreements with and powers to local authorities, companies and others.

Halesowen.—Prov. order to George Balfour to supply within rural district.

Heswall.—Powers to Wirral R.D.C. to supply within township of Heswall-with-Oldfield.

Keighley Corporation.—Various powers concerning electrical department, including supply in bulk, or for tramways or railways outside the borough.

Leicester Corporation.—Supply of electricity for power purposes from tramway station; also various further provisions concerning electric supply to consumers.

Llandaff and Dinas Powis R.D. Council.—Extension of time under, and amendment of, 1901 order.

Llansamlet.—Powers to Swansea R.D.C. to supply electricity in this parish.

Lowestoft Corporation.—Amendment of 1898 order and inclusion of Oulton Broad Urban District. Agreements between Lowestoft Corporation and Oulton Broad U.D.C.

Lymington Electric Light and Power Co., Ltd.—Extensions.

Macclesfield.—Extension of time to Corporation under 1901 E.L. Order.

Oulton Broad.—Prov. order for U.D.C.

Portsmouth Corporation.—Provisions as to the supply of energy to consumers having separate supply.

Ravensthorpe.—Powers to U.D.C. concerning electricity supply in bulk, transfer of undertaking, supply of electric fittings, and so on.

Southampton Corporation.—Provisions as to supply to consumers having separate supply; power to refuse supply in certain cases.

South Wales Electrical Power Distribution Co.—Powers as to sale of generating stations, and as to agreements with the Treforest Electrical Consumers Co., Ltd., and others. Repeal of 1903 Carmarthenshire Power Act, and other provisions.

Southwell District Gas Co.—Power to apply for prov. order for electricity supply.

Sowerby Bridge.—Application by R.D.C. for amendment of 1900 Order. Extension of time, provisions as to transfer, and other matters.

Tewkesbury Corporation.—Amendment of 1905 Order, and provisions with respect to transfer of powers.

Thornhill.—Powers to U.D.C.

Warmley.—Amendment of Council's 1903 E.L. Order. Extension of time. Transfer powers (Kingswood Electric Supply Co.).

Woking.—Powers to the Woking Electric Supply Co., Ltd., in Staines, Laleham and Littleton, and various parishes in Middlesex and Surrey.

London Power Proposals.

London and District Electricity Supply.—Company to be formed to generate and supply electricity in Administrative County of London, and portions of Middlesex, Essex, Kent, and Surrey.

London Electric Supply Companies and Others.—Joint Committee of London Electrical Supply Companies with powers for addition of L.C.C. and other authorities' representatives. (See ELECTRICAL REVIEW, November 22nd, p. 859.)

London (Westminster and Kensington) Electric Supply Companies.—Agreements between Westminster, Kensington and Knightsbridge, Notting Hill, St. James', and Central Electric Supply Companies as to bulk supply. Amendment or repeal of certain provisions in Acts of 1882 and 1888, exemption from Building Acts, relief from proceedings for nuisance, and other powers.

II—Electric Tramway and Railway Proposals.

Birkenhead Corporation.—Additional tramway powers.
Blackburn Corporation.—New tramways and incidental works. Powers concerning supply to premises having separate supply.
Blackburn, Whalley and Padiham.—Powers to B.W. and P. Light Railways Co. for revival of powers granted by 1901 order.
Bolton Corporation.—Various tramway provisions.
Bristol.—Extension of time for construction by Bristol Tramways and Carriage Co., Ltd., of tramways authorised by 1904 Act.
Burnley Corporation.—New tramway powers. Provisions as to supply in bulk to other authorities, and various electrical supply matters.
Croydon and Southern District Tramways.—New company to construct tramways in Beddington, Coulsdon and Warlingham.
Doncaster Corporation.—Certain new tramways.
Erith.—Various tramway powers for the U.D. Council.
Great Northern, Piccadilly and Brompton Railway.—Repeal of sections of previous Acts, cancellation of certain agreements, conversion of share capital, and numerous other powers.
Highgate Hill.—Power to H.H. Tramways, Ltd., to work electrically.
Kingston-upon-Hull Corporation. — Construction of new tramways.
Leeds Corporation.—Tramways in urban districts of Horsforth, Rawdon, Yeadon and Guiseley. Transfer of tramways in Pudsey.
Liverpool Corporation.—Tramway extensions in the city.
Liverpool Corporation.—New tramway in Litherland urban district.
Llandudno Pier Co., Ltd.—A line of tramway to run along the widened pier; power to generate and supply electricity.
Macclesfield and District Tramways.—Abandonment of undertaking and dissolution of company.
Manchester Corporation.—New Tramways in Moss Side and Withington townships.
Metropolitan District Railway Co.—Financial and other incidental powers.
Metropolitan Electric Tramways, Ltd.—New tramway in Paddington; revival of powers and extension of time under Harrow Road and Paddington Tramways Act, 1904, and Metropolitan Electric Tramways Act, 1905.
Morecambe Corporation.—Acquisition and electrification of tramways of Morecambe Tramways Co.
North-East London Railway Co.—Extension of time within which capital is to be subscribed.
Nottinghamshire and Derbyshire Tramways Co.—Extension of time under 1903 and 1906 Acts.
Potteries and North Staffordshire (Amendment).—Potteries Electric Traction Co., and North Staffordshire Tramways Co., Ltd. Alteration of tramways, &c.
Rochdale Corporation.—New tramways; also powers as to supply of electricity outside borough.
Stockport Corporation.—New tramroad in Hayfield.
Southend and Colchester.—Light railways; powers to S. and C. Light Railways Co.
Wolverhampton Corporation.—Additional tramway powers, also power to lay electric mains in private streets.
London County Council (Tramways and Improvements).—New tramways in the county, also sundry incidental provisions. Agreements with Metropolitan Electric Tramways, Ltd., as to use and purchase of tramways of that company.
London United Tramways, Ltd.—New tramways in Middlesex and Surrey.
West London, Barnes and Richmond Tramways.—Company to construct tramways in Hammersmith, Wandsworth, Richmond and Barnes.

General.

Commissioners of Works.—Powers to enter into agreements with the Council of the Institution of Civil Engineers as to the re-erection of the building of that Institution on a site to be provided by the Commissioners.
East Metropolitan Power Gas Supply.—Power to British Coalite Co., Ltd., to supply power gas for power, heating, &c., in West and East Ham, Barking Town and North Woolwich.
King's College (London).—Transfer of certain departments to University of London.
London Motor Roadways Approach.—Construction of roadways for motor vehicles, alterations of levels of roads and streets in London, Middlesex and Bucks, power to Metropolitan Electric Supply Co. and others to supply energy.

What New York Spends.—Comptroller Metz, of New York City, recently stated that: "The city budget is enormous. Each month $1,000,000 is paid out in cash for salaries, and the salaries altogether, for the whole year, come to $71,000,000. The city spends annually $400,000,000—that is, more than London, Paris, and Berlin all put together. This means that we are doing in one year what they did in centuries. The city is growing tremendously, and we are rebuilding it from end to end. At present, $50,000,000 is pledged to the city for parks and bridges, which we must have." He might have added that the city cannot show one well-paved street, and that its municipal supply of drinking water is vile. The only public services at all well run are those under private or corporate management.—*Electrical World.*

THE USE OF THE DUDDELL ARC FOR INDUCTANCE AND CAPACITY MEASUREMENTS.

The scope of the telephone bridge in combination with a high frequency generator for measuring small inductances and capacities is limited partly by the comparative insensitiveness of the ear, and partly by the difficulty of attaining the very high frequencies necessary for accentuating the capacity and inductance effects relatively to the ordinary resistance effect.

In a recent number of the *Elektrotechnische Zeitschrift* Herr Heinke describes a number of methods of employing the pure high-frequency alternating currents, obtainable from the Duddell arc, for such measurements, either with the telephone bridge or, more simply, by the use of ordinary hot-wire or electrostatic instruments.

The arc he employs is a small 3-ampere shunt lamp, fitted with solid carbons (a 9-mm. one above and a 6-mm. one below) and run off a battery of 65 volts through a regulating resistance and a choking coil. If desired, the lamp can be run equally well off 110 volts by employing a little more resistance. The operation of the lamp offers no difficulties, especially as it is generally working below its normal current, viz., at from one to two amperes. The high-frequency alternations are set up in a circuit connected as a shunt to the arc and containing a small paper condenser of about one microfarad and a small amount of self-induction, which is varied according to the frequency desired. Thus, if the self-induction is only that of the condenser leads, a current of five or six amperes will flow in the shunt circuit, with a frequency of from 30,000 to 50,000, whilst if the capacity is reduced to ·01 microfarad, the frequency can be raised to as much as 150,000. If the self-induction is increased, the current and the frequency fall. If the damping is negligible, the frequency is given by—

$$\frac{1}{2\pi}\sqrt{\frac{1}{L \times C}},$$

whilst if an appreciable loss takes place, such that the equivalent resistance $R = \frac{\text{watts lost}}{(\text{current})^2}$, the frequency is—

$$\frac{1}{2\pi}\sqrt{\frac{1}{L \times C} - \left(\frac{R}{2L}\right)^2}.$$

When L had been increased to about 80 millihenries the practical limit of satisfactory working was found to have been reached. The current was then under one ampere, and the frequency about 500.

By means of special arrangements greater variations of frequency can be attained, but the above range provides all that is necessary for test purposes.

Fig. 1 shows the connections of the arc for comparing two inductances L_x and L_n by means of the telephone bridge. This arrangement greatly increased the range and sensitiveness of the bridge as compared with the results attained with the ordinary

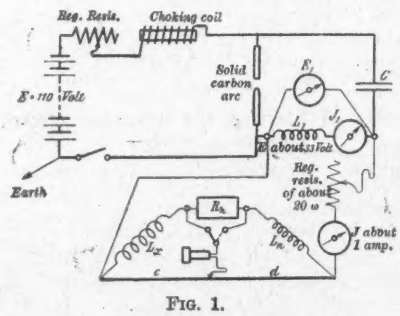


Fig. 1.

high-frequency generators, but the telephone receiver proved rather troublesome, due to earth leakage through the operator. Partly in order to avoid this, and partly to meet the preference for direct-reading instruments, the connections shown in fig. 2 were tried with very good results. If L_x and L_n, the inductances to be compared, do not exceed the limiting self-induction, they can be directly inserted in the circuit in place of L_1 (fig. 1), otherwise they should be connected in parallel with L_1.

A measurement is then made of the high-frequency current J and of the two voltages E_x and E_n across the self-inductions. The current is best measured with an unshunted hot-wire ammeter, or if a shunt is necessary, this should be of thin strip rather than of wire, since the former is free from appreciable skin effect, at any rate, up to the frequency of the highest audible note. The voltages can be measured by a hot-wire voltmeter (with one or more incandescent lamps in series, if necessary, to get the reading on to the best part of the scale). The error introduced by the current taken by the voltmeter can usually be neglected, especially as it will be displaced something like 80° relatively to the current J. In most cases the ohmic resistance of L_x and L_n can

also be neglected, and the value of L_x taken as $L_n \times \frac{E_x}{E_n}$. The frequency can be determined from the formula—

$$\text{Frequency} = \frac{E_n}{J \times L_n \times 2\pi}.$$

Taking this value, the correction for resistance can be readily allowed for if necessary.

As an example the method was employed to compare the inductances of the two coils of a wattmeter.

The self-induction of one coil was first measured by another method, and found to be ·0937 millihenry. The two coils were then connected in series as in fig. 2, and J was found to be 3·4 amperes, and the voltage across the known inductance (taken by

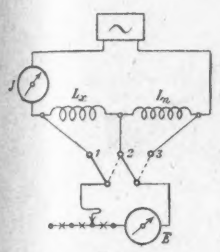


FIG. 2.

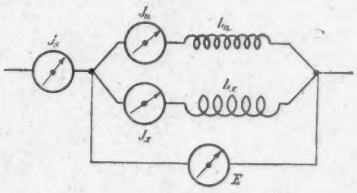


FIG. 3.

hot-wire voltmeter) was 8·1 volts, whilst that across the other coil was 19·2 volts. The inductance of the latter is, therefore, $\cdot0937 \times \frac{19\cdot2}{8\cdot1} = \cdot222$ millihenry.

When L_n and L_x differ considerably, and also when measuring very small values of L, it is often more convenient to use the parallel connections shown in fig. 3. Then—

$$\text{Impedance of } x \text{ circuit} = \text{impedance of } n \text{ circuit} \times \frac{J_n}{J_x},$$

and considering that—

$$\text{Impedance} = \sqrt{(\text{resistance})^2 + (2\pi f \text{ inductance})^2},$$

it is generally sufficiently accurate to put—

$$\text{Inductance } L_x = \text{inductance } L_n \times \frac{J_n}{J_x}$$

for the high frequencies employed, even supposing that the equivalent alternating current ohmic resistance is considerably higher (owing to skin effect, &c.) than the direct-current ohmic resistance.

The author also gives connections for measuring coefficients of mutual induction and condenser capacities.

It seems probable, however, that in the measurement of capacity by this method, considerable errors would be liable to occur, owing to irregularities in the wave form of the measuring current.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

New Method of Starting and Protecting Alternating-Current Motors.

MR. GEORGE ELLISON, of 17 and 18, Warstone Lane, Birmingham, has just put on the market an automatic alternating-current motor starter which is based on an entirely new principle.

It is claimed that by means of the present device any alternating-current motor will be protected in an efficient and extremely simple manner against overload, no voltage *on all or any* of the phases, and also against carelessness and inexperience of attendants.

The accompanying illustration, fig. 1, shows the starting and protecting device suitable for a three-phase induction motor, and it will be noticed that it is fitted with an overload coil, which is in series with the secondary or rotor circuit of the motor, and a no-voltage release coil which is connected across one of the primary or stator phases. In addition to this, rings and contacts are also provided, and are arranged in such a manner as to open the stator circuit of the motor when the brush-carrying lever is in the "off" position.

Describing the apparatus more in detail, in fig. 2, R is the rotor, S the stator, L the line, A the overload coil, and B the no-voltage coil already referred to. The overload coil A is disposed in such a manner as to open the circuit of the no-voltage release coil B in case it should operate—that is, if an overload should occur. Fig. 2 shows the connections when the motor is running. In starting up the motor the brush-carrying lever C closes first the primary or stator circuit of the motor, and is then successively moved over the various contacts C^1, C^2, C^3, C^4, C^5, finally reaching the last contact C^6, or the running position where all the resistance is cut out, and where it is held closed against the tension of a spring D by a suitably-arranged hook H. The spring D for commercial purposes is situated in the centre of the brush-carrying lever C, but for the sake of clear illustration it is here arranged as shown in fig. 2.

To make clear the working of the device, we will suppose that through some cause the supply is cut off from the motor. In such a case the no-voltage release coil B receives no current, and will consequently release its core, which is arranged so as to fall down on the hook H, and the brush-carrying lever C at that moment, through the influence of the spring D, flies back to the "off" position and thus disconnects the motor from the line.

If the motor is overloaded, it is obvious that the current in the rotor circuit will increase in practically the same proportion as the

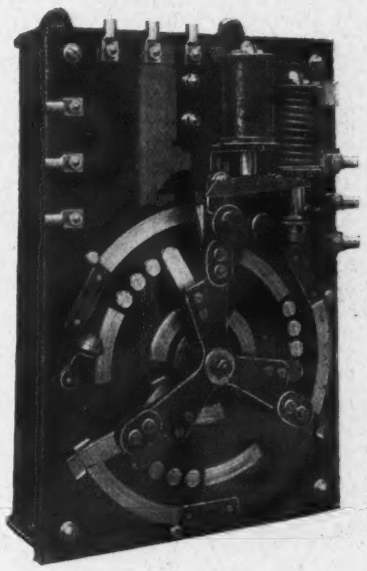


FIG. 1.—A.C. MOTOR STARTER.

stator or line current, and the overload coil, therefore, will operate. In doing so the same opens the circuit of the no-voltage release coil B, and the brush-carrying lever C again flies back to its "off" position as before, thus disconnecting the motor from the line.

If the supply should be cut off on one of the phases only, as sometimes happens when one of the main fuses blows or through the breakage of a wire, the motor will keep on running as a single-phase motor, but the rotor current will increase in a most dangerous manner even if the motor carries only a comparatively small load. The overload coil A in such a case will immediately operate, and this causes the motor to be cut off from the line as before.

The application of the present method, besides protecting the motor against the above-mentioned contingencies, will also safe-

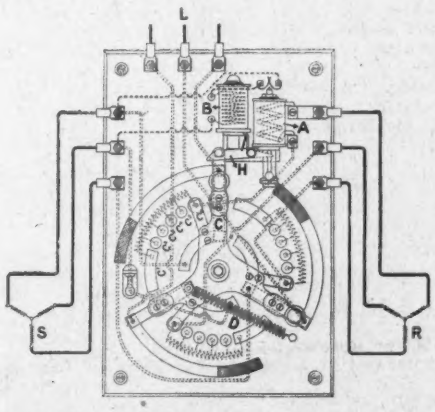


FIG. 2.—DIAGRAM OF CONNECTIONS.

guard it against the inexperience and carelessness of attendants, as the starting-up of the motor is done by one operation only.

From the foregoing description it will readily be seen that the overload coil A, instead of opening the circuit of the no-voltage release coil B, could also be arranged so as to act directly on the hook H. This arrangement is shown in fig. 1, and, for convenience in manufacturing, it is to be preferred. To realise this the hook H has simply to be made slightly longer, as indicated in dotted lines in the connection diagram, fig. 2.

For protecting alternating-current motors already installed, and which are merely equipped with an ordinary non-automatic starter or controller and a fused switch, the inventor is also putting on the market a new patent alternating-current circuit-breaker which works on exactly the same principle. If, for instance, such a circuit

breaker has to protect an existing three-phase induction motor, the former will be equipped with three brushes in order to open all the primary phases, an overload coil will be put in the rotor circuit of the motor, and a no-voltage release coil will be connected across one of the stator phases, and thereby complete protection is obtained.

"Multum" Manufactures.

In figs. 3 and 4 we illustrate the "Multum" combined switch and fuse manufactured by Messrs. Ward & Goldstone, of Springfield Lane, Salford. This device has been designed particularly for

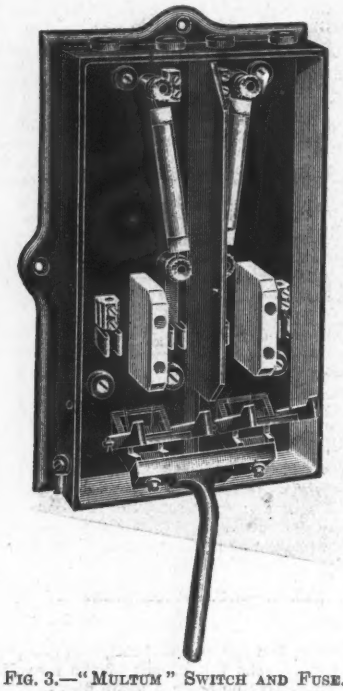


Fig. 3.—"Multum" Switch and Fuse.

power work and main switches. The switches and fuses are mounted in the one iron case, but a simple locking device (provisionally protected) on the handle, prevents the fuse-cover being

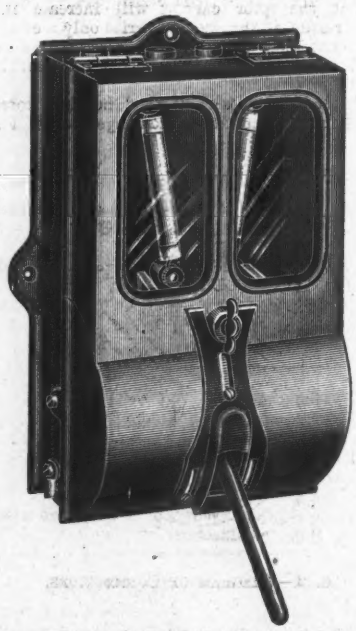


Fig. 4.—"Multum" Switch and Fuse.

opened when the switch is in the "on" position. It is claimed that the use of this switch saves considerable time in wiring, that it renders the earthing arrangement reliable and simple, and that the fuse cover protecting device assures increased safety in use. The firm's list gives prices for the 30, 50, 75 and 100 amperes capacity sizes, suitable for 250 and 550 volts. In another publication of this firm is shown a pocket electric lamp with accumulator, which gives from six to eight hours' light at a time, and can be used continuously. It is fitted with a special ebonite accumulator, unspillable, and is designed for practical use—not as a toy. The lamps are complete with a metal filament (tungsten jewel) bulb and accumulator, and they will fit in the waistcoat pocket.

Aluminium Reflector for Osram Lamps.

A new aluminium reflector (registered design) has been placed on the market for Osram lamps. Owing to the length of these lamps, ordinary reflectors fitted on shade carriers are not very suitable for use with them. The "Effulgent" reflector, however, fits

Fig. 5.—Osram Lamp with Reflector.

securely to the cap of the lamp; it is extremely light, and owing to its shape considerably increases the illumination in the vertical direction, where it is greatly needed. As mentioned before in our columns, these reflectors are also made for ordinary carbon and tantalum lamps, by the "Attracta" Electrical Co., 4 and 5, Warwick Court, High Holborn, W.C.

PROCEEDINGS OF INSTITUTIONS.

The Magnetic Testing of Iron.

By W. H. F. Murdoch, B.Sc., A.M.I.E.E.

(Institution of Electrical Engineers, Leeds Local Section.)

The discussion on this paper on November 25th (see abstract in our last issue) was opened by Mr. J. W. Beauchamp, who asked whether the author had made experiments with sheet iron such as is used for transformer work, and if it was necessary to put the strips edgewise on the pole pieces.

Mr. W. N. Y. King said the size and cost of electric generators of given output had, of late years, been much reduced by the increase in the speed of driving and by the use of high permeability steel. Interesting results would have been obtained if the author had continued his tests with higher values of B.

Mr. W. T. Wardale, referring to the starting friction, thought a push with the finger somewhat indefinite.

Mr. T. W. Sampson pointed out that the specimen on the table had been filed, properly surfaced, and scraped very carefully, and it seemed to him that although they might gain to some extent in the simplicity of the test, they would not gain much advantage as regards the time occupied in the preparation of the specimen. In winding the specimen and calculating the value, it seemed to him that considerable error might be made, especially with a rough specimen, the area of which could not be obtained very accurately.

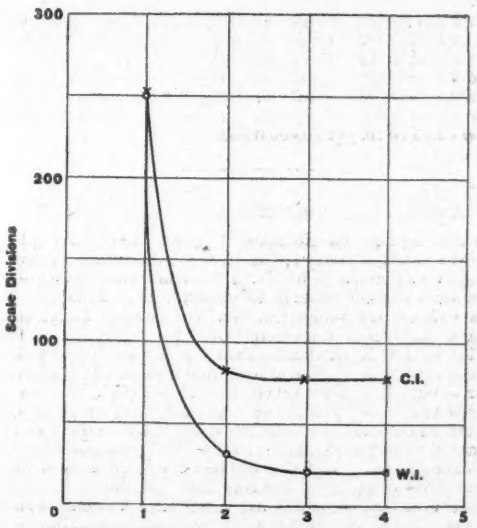
Mr. R. P. Lovell suggested that the question of starting friction need not be considered if a weight was put into the scale pan which was just sufficient to cause a slow movement of the bar in the direction of its length. In order to eliminate the disturbing effect of the ends of the bar as it was moved along, these ends should project well beyond the yoke. The current might be led into the coil through mercury troughs placed parallel to the direction of motion. The arrangement might be calibrated by placing known weights on the top of the bar under test, the bar being in a demagnetised condition.

Mr. W. E. Burnand pointed out that the pressure exerted between the contact surfaces depended not only upon the total flux but on the distribution of the flux, being greater with an uneven than with an even distribution, and as this distribution would vary at different parts of the B/H curve, some error would naturally be introduced.

Mr. T. E. Herbert said the method described would require a considerable amount of practice. It was apparently of a simple character, but he did not think it was "fool-proof," and that was the thing to be aimed at.

Mr. W. H. F. Murdoch, in reply, said he had not yet made any experiments on sheet-iron. With reference to tooling, if one considered a small cylindrical specimen, the mass of the material acted upon by the stresses due to turning in a lathe had a much greater ratio to the total mass of the specimen than in the large specimens he used. There was no reason why higher values of B should not be used. A method of eliminating the starting push was to use the screw starting arrangement shown, by which the

specimen was always given an equal starting push. At the same time he did not consider this at all necessary. The errors were of the same magnitude and opposite in sign, so that they cancelled out completely. With reference to determining the value of H, in the double-yoke method the value was almost completely free from error. In the single-yoke instrument the orders of the error were indicated, and there was no reason why these should be excessive. On a large specimen any error due to the area of the coil being different to that of the specimen itself, would have a less percentage effect than in the case of a small specimen. The size of specimens might vary within wide limits according to the method of testing double or single yoke, and the permeability of the specimen. He thought it possible with a properly designed instrument to get an accuracy of 1 per cent., and he hoped to manage this with an improved type. It did not matter whether the coefficient of friction was exact or not, so long as the tests were made by the same experimenter, as the errors cancelled. Regarding the distribution of flux over the gaps, it was, of course, essential, in order that the law of traction might be obeyed, that this should be uniform. From ballistic tests he had made over gaps, so long as the pieces formed a well-faced gap, the distribution was fairly constant. The difficulty was more a question of correct facing of the gap surfaces than of flux distribution, since the use of a narrow gap would eliminate any errors due to flux distribution. Neither did he find the flux altering perceptibly as the bar was allowed to slide. Regarding the shape of the specimen, there was an advantage in having this of such a shape that it demagnetised itself quickly. He simply reduced the magnetism by reversing the current, and inserting resistance in the circuit till the current was, say, half an ampere. That left the bar with a certain amount of residual magnetism, and when it was pulled off the yoke the magnetism went down to a small value. A few experiments were made on cast-iron and wrought-iron bars. In the figure the ordinates represented the deflection of the ballistic



Demagnetisation of Iron Bars.

galvanometer, and the abscissæ the number of times the bar was lifted off the yoke. The galvanometer was damped in each case, so that the intervals were about the same—viz., 25 seconds. The wrought-iron demagnetised much faster than cast-iron, and sank to a lower final value. The pull corresponding to an induction of about 200 lines per sq. cm. in the cast-iron bar was hardly measured by this instrument, so that there was no necessity to demagnetise it further. His experiments showed that the yoke residual induction was only $\frac{1}{10}$th of that of the wrought-iron bar, so that it was quite negligible.

The Production of Power from Peat.

By T. Tomlinson, B.A.I., M.I.E.E., M.I.C.E.I.

(*Abstract of Address before the* Institution of Electrical Engineers *at Dublin, November 21st*, 1907.)

Successive failures in attempts to deal with peat as fuel, on a commercial scale, have so discredited it, that there is great danger that Irish engineers and capitalists—remembering these failures and not inquiring into the causes—may allow the exploitation of our great industrial asset to pass into the hands of outsiders.

I am firmly persuaded, and I hope to show you, that, through work already done and advances already made, the commercial utilisation of peat for power is a very ordinary bit of engineering journeyman's work, and that it can be undertaken whenever the capitalists will find the money.

On May 17th, 1907, *Engineering* had an article on a recent test of a peat-gas and ammonia-recovery plant, the gas being used to drive a gas engine. The account of the trial is as follows:—

"The method adopted in the experiments at Winnington was Dr. Caro's process for the gasification of inferior fuels by means of air and superheated steam. The experiments were made in the Mond gas plant, and the resulting gas utilised in the gas engines; the superintending engineer was not informed that he was burning a special mixture, and he did not notice any difference. The peat came from Italy, the special machinery having been constructed for that country. Altogether 650 tons of this peat were gasified. The peat contained about 40 per cent. of water—the percentage varied—and in the dry state 15·2 per cent. of ashes; volatile substances, 43·8 per cent.; nitrogen, 1·6 per cent.; and 34 per cent. of carbon. A ton of dry peat yielded 1,780 cb. metres of gas of 1,360 large calories (about 150 B.Th.U. per cb. ft.), and 55 kilogrammes (118 lb.) of ammonium sulphate; this amount of ammonia was really obtained, and not only calculated. The gas generated was partly utilised for raising the steam required for the process, and also for evaporating the ammonium sulphate, and it gave, in addition, 480 H.P.-hours in the internal combustion engine; that is to say, the ton of dry peat yielded 480 H.P.-hours, in addition to 66 per cent. of its contents of nitrogen as ammonium sulphate. An estimate of the cost shows that under such conditions peat and producer gas has a good prospect of being financially successful. Not reckoning the value of the ammonium sulphate, the horse-power-hour cost less than 0·5 pfennig (0·06d.)."

Now, I think you will agree with me this far at any rate that a test like that raises the problem out of the experimental stage and brings the matter within the sphere of practical engineering.

It has at any rate done so in the case of certain foreign capitalists and engineers, for in *Engineering* of May 31st, 1907, Mr. Mond wrote referring to the above quoted article:—

"In consequence of these tests we have now concluded a contract with the Societe per l'Utilizzazione dei Combustibili Italiani, Milan, for a 2,000 H.P. ammonia recovery peat gas plant for a central electrical distribution station, to be driven by gas engines consuming peat gas. This plant is now being constructed at our works, and we expect that it will be operating at the end of this year."

"We have also utilised successfully Swedish and other peats."

Assuming that the generating station of the Italian company is at the bogside and that the waste heat is utilised to dry the peat, then we may take it that there is now in progress of erection in Italy a plant embodying that solution of our problem which I resolved to make the subject of this address.

It does not appear from the extract (which is all the information I have) that the waste heat is to be utilised, in the Italian case, to dry the peat, which under the climatic conditions of Italy may not be necessary; but I am perfectly satisfied that air drying cannot be relied on in Ireland, where Nature, in a jesting mood, gave us 2,500 million tons of easily accessible fuel, but waterlogged it to the extent of 90 per cent., and, to crown the jest, gave us one of the dampest climates in Europe.

The one thing which distinguishes the scheme of utilisation, which we are considering, from all others tried here, of which I have any knowledge, is this:—That it makes available for the absolutely necessary drying, 60 per cent. of the total heat value of the peat—this makes the thing possible from an engineering point of view; after it has thus been made possible, the recovery of the sulphate of ammonia makes it profitable as a commercial undertaking, or perhaps it would be more accurate to say that the value of the sulphate of ammonia per ton of dry peat covers, and, in my opinion, more than covers the cost of getting the peat and reducing it to such a state of dryness as enables the rest of the drying process to be carried out in the producer.

Let us first consider the question of the value of the sulphate of ammonia per ton of dry peat, which it is scarcely necessary to say is recovered by passing the gas through sulphuric acid. On this point there is a fair agreement.

Engineering, in the extract quoted, gives 118 lb. "really obtained and not only calculated."

Mr. Rigby, in a paper read in March, 1906, before the Engineering and Scientific Association of Ireland, gave 130 lb., and I have a recent analysis of peat samples, taken by myself from three different levels in an Irish bog, from which an expert in producer plant states 85 lb. per ton of dry peat is recoverable; the figure varies according to the percentage of nitrogen in the peat and the manner of working the plant. Taking the last figure, we have 1 ton of sulphate of ammonia for every 26·5 tons of dry peat.

Now a ton of sulphate of ammonia is worth £12, and the sulphuric acid is worth about £1 10s., leaving a net value (exclusive of labour, interest and depreciation of plant) of £10 10s. or 7s. 11d. per ton dry peat, say, 7s. Now, 7s. per ton of dry peat is 3s. per ton of peat containing 40 per cent. of moisture (air dried peat), so that virtually the problem of peat utilisation is narrowed down to the getting of peat equal to air dried at a cost as near 3s. per ton as possible. If you can get it at that price you have fuel free.

Lest you should think I overstate the case in stating free fuel as possible, let me read you an extract from the *Engineer* of June 29th, 1906. At the lauch of H.M.S. *Agamemnon*, Mr. Beardmore, chairman of the Naval Construction Works, Dalmuir, is reported to have said:—

"The yard was also unique in this respect, that it was the first establishment of such proportions in which steam as a motive power had been entirely discarded. All the machines were driven by electric motors, and those motors were worked by electricity generated by internal combustion gas engines. The gas they used for power purposes they first of all chemically treated, so as to extract from it the nitrogen, which was of no use for heating purposes, but was of great value for fertilising purposes. The result was that by taking from the gas that nitrogen and forming it into sulphate of ammonia, they found that when they came to square

their accounts that their coal bill was entirely paid by the money received for sulphate of ammonia."

It is not possible in this country to get air-dried peat at 3s. per ton with manual labour and open air drying, as is the universal practice in Ireland; but there is no reason why it should not be got and dried at this price if machine-getting and drying by waste heat were adopted.

Mr. Tomlinson then proceeded to describe shortly the capabilities of several machines for doing this, the yield, reduced to dry peat varying from 2 tons per man per day for a hand power machine to 24 tons per day for a power-driven machine, but in the latter case the power required is 10 B.H.P.-hours per ton of dry peat.

That the work can be done for about 2s. 6d. per ton of dry peat, I have been assured by Mr. Lennox, an engineer and expert in this matter of peat getting and drying, and the inventor of drying apparatus now in successful operation, to whom within this past week I submitted the problem with a statement of the waste heat available.

The vital question then is: Is there enough waste heat available to deal with the moisture contained in the peat after the surplus moisture has been pressed out by power, or drained or dried out by exposure?

First, let us clearly know what we have to do. Turf *in situ* may contain 90 per cent. of moisture; it can be fed into the producer with 40 per cent. to 45 per cent of moisture, the heat of the escaping gases (which must in any case be cooled before use) extracting that amount of moisture from the peat as it approaches the combustion zone. By pressure or drainage and exposure, the 90 per cent. of moisture can be reduced to 70 per cent., so that the problem reduces itself to this—

Is it possible to reduce peat from 70 per cent. of moisture to 45 per cent. of moisture by the waste heat of the gas engines at a realisable efficiency of utilisation of the waste heat.

Let us consider 100 lb. of dry peat (chemically dry): At 90 per cent. moisure, this will be associated with 900 lb. of water; at 70 per cent., with 233 lb.; at 50 per cent., with 100 lb.; at 45 per cent., with 82 lb. We have, therefore, to evaporate $233 - 82 = 151$ lb. water, and taking 1,100 B.TH.U. per lb. of water, we shall require 166,100 B.TH.U.; if drying by compression or exposure to 60 per cent. moisture were resorted to, we should require to evaporate $150 - 82 = 68$ lb., requiring 74,800 B.TH.U.

Now 100 lb. of dry peat contains 864,400 B.TH.U. (from the analysis already referred to), and of this 648,000 is realisable as gas: the Mond trial gave 675,000. Assuming this gas to be used in a gas engine with a thermal efficiency of 30 per cent., 194,400 B.TH.U. will be given as power (= 76 I.H.P.-hours) and 454,000 B.TH.U. will appear as waste heat in exhaust and cooling water.

The required efficiency of utilisation will then be $\frac{166,100}{454,000}$ = 36 % if the peat is dried to 70 % moisture, and $\frac{74,800}{454,000}$ = 16 % if the peat be dried to 60 % moisture.

The question then arises—is that a realisable efficiency in actual practice. I have but one recorded trial from which it is possible to estimate the efficiency. In a 10-hours' test of the "Dobson" dryer, as recorded in the "Report of the Bureau of Mines," Toronto, 1903, the following results were obtained: "Weight of air-dried peat charged into the dryer, 29,300 lb., containing 34·21 per cent. water; weight of peat discharged from dryer, 23,000 lb., containing 16·61 per cent. water. The weight of water evaporated was 6,300 lb. Air-dried peat containing 34 per cent. water was used as fuel at the rate of 3,145 lb. per day of 10 hours."

From these data we can estimate the efficiency thus: 3,145 lb. peat, 34 per cent. moisture, consists of 2,096 lb. dry peat and 1,048 lb. moisture; adding to this latter the 6,300 lb. of water evaporated from the peat, we have a total of 7,348 lb. of water evaporated by the combustion of 2,096 lb. of dry peat. The efficiency, therefore, was $\frac{7,348 \times 1,100}{2,096 \times 8,644} = 45$ per cent. As we require only an efficiency of 36 per cent. we are evidently well within the limits of practical efficiency. This is the more certain because the heat available was not, in this experiment, used to the best advantage as the heat carried away in the escaping gases and evaporated moisture was allowed to escape to the atmosphere without further utilisation, which certainly would not be done if it were sought to use a fixed quantity of heat to the best advantage. Note also that peat was dried from 34 per cent. of moisture down to 16 per cent. moisture, within which range it is reasonable to suppose the efficiency would be less than with peat dried from 70 per cent. to 45 per cent.

Of power, to get pressure assistance in the drying of the peat, there is ample, 76 I.H.P. per 100 lb. dry peat, or, say, over 1,000 B.H.P.-hours per ton—10 per cent. of which would certainly provide all the power necessary for the getting, conveying, pressing and drying of the peat.

Two matters have not yet been dealt with:—The heat necessary to raise steam for the producer and the heat necessary to evaporate the sulphate of ammonia. The first amounts to that necessary to convert about 25 lb. of water at the temperature of cooling water of the engine to steam (= 27,500 B.TH.U. about) per 100 lb. of peat.

For the second I have no data, but as the amount of sulphate of ammonia is only about 3·3 lb. per 100 lb. of peat it should not amount to much.

It is, of course, a waste of heat to use the gas before being used in the engine to generate this heat—as apparently was done in the trial referred to in *Engineering*.

My belief is that the difference between the 36 per cent. shown to be necessary with the compression of the peat to 70 per cent. moisture, and the 45 per cent. shown to be attained in practice, is ample to cover contingencies; but if it were not so, then drying by compression or exposure to 60 per cent. moisture, increased efficiency of heat utilisation, air-drying under cover after pressing, and, finally, storage of air-dried peat harvested in good summers, puts it, I submit, beyond the possibility of doubt, that there is obtainable from 1 ton of dried peat, or 10 tons of peat *in situ*, about 1,000 B.H.P.-hours as power, and that the fuel for this power will cost nothing, the cost of getting the peat and extracting the moisture being covered by the value of the sulphate of ammonia recovered.

We, in Ireland, are so familiar with the fact that the wetness of the peat and our climate have wrecked so many schemes of peat utilisation that it is rather a difficult matter to get a patient hearing for the demonstration of the fact that a scheme of utilisation which provides over 60 per cent. of the fuel value of the peat (for the heat of the gases is over 10 per cent.) for this purpose, is an entirely different thing to schemes in which it is attempted to carry the whole fuel value off the bog, as in pressed peat schemes and the like, which, so far as I can see, must always fail. One does, however, generally succeed in this; but then one is often met by the objection: What market is there for cheap power generated on the bogs of Ireland? I need not tell you that, with one-seventh of its limited area under bogs, very little of Ireland is beyond the reach of economical electrical transmission of cheap power from these bogs; that Ireland is not such a howling industrial wilderness that there is no demand for cheap power and light in her towns and cities, nor that even if it were so, is Ireland so far from the industrial and distributing centres of Europe that cheap power, cheap sites, cheap labour, and cheap carriage—for her bogs are traversed by canals and navigable rivers, should not attract industries to which these are essential.

A further objection may be raised. If this can be done with peat, it can be done as cheaply or cheaper with coal, and Ireland for cheap power production will be in no better position as compared with England. This is not so, for the following reasons:—

1. Peat is very much more easily got than coal, and is not dependent on specialised and highly-organised labour for its mining.

2. Peat has no exportable calorific value as compared to coal, and its value is, therefore, not regulated by an enormous demand for purposes other than power production.

3. Peat has a very much higher percentage of fixable nitrogen per thermal unit than coal, so that the return in sulphate of ammonia for a given horse-power is greater. Peat has about 98 lb., and coal 60 to 70 lb. per 10,000 B.TH.U.

American Institute of Electrical Engineers.*

At the meeting held on November 8th, the comparative performance of steam and electric locomotives was discussed; a paper on this subject was presented by Mr. A. H. Armstrong, and an abstract of it was given in our issues of November 22nd and 29th.

In a written communication, Mr. W. J. Wilgus mentioned the striking advantages of the electric over the steam locomotive as found in the New York Central installation. In this installation coal consumption per car-ton mileage in high-speed steam service, as compared with low-speed service, is 165 per cent., whereas under exactly the same conditions, the increased consumption of energy for electrical equipment is only 18 per cent., a difference in favour of electrical operation of 147 per cent. The net results of all of the economical advantages of electric operation over steam, for the conditions existing on the New York Central, after including all elements of cost of additional plant, show a saving in summer months of from 12 per cent. to 27 per cent., depending on the character of the service. A larger saving may be expected under winter conditions.

In addition to the above saving, the nuisance and dangers from smoke and gas in the Park Avenue tunnel have been eliminated, and the passenger service of the Grand Central terminal has been increased by about one-third. Later, when the New Haven Co. completes its change of system, exclusive electrical operation in the tunnel will permit the use of shorter blocks, and correspondingly increase the service of the four-track main line entrance to the terminal.

Because of less cost of maintenance of electrical equipment, and less idle time in shops, the greater cost of interest charges and depreciation is not only neutralised, but a net saving in repairs and fixed charges over steam equipment is effected of 19 per cent. Electric locomotive inspection and light repairs, as compared with coaling, watering, drawing fires, repairs, &c., of steam locomotives, shows a saving in time in favour of the former of over four hours per day, equal to 18 per cent. The electric locomotive, while busy, is a much more nimble and efficient machine than the steam locomotive, showing an increase in daily ton-mileage of 25 per cent.

While not so important in freight service, the question of locomotive weight is a large factor in a comparison of the relative economy of handling passenger traffic by steam and electricity. For instance, in switching service at the Grand Central terminal, 65 per cent. of the total steam ton-mileage is due to locomotive or "dead" weight, while the electric locomotive percentage is only 54 per cent., a saving for the latter of 11 per cent. In the regular schedule service, the steam locomotive shows 51 per cent. dead ton-mileage, as against 35 per cent. for the electric equipment, a saving for the latter of 16 per cent. When it is realised that this saving of "dead" ton-mileage has a direct proportionate effect on the cost of fuel and electric energy, and an indirect effect on wages and fixed charges, its importance is manifest.

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* Abstract of discussion reported in the *Electrical World*.

Dr. Cary T. Hutchinson said that the constant-speed characteristic of three-phase motors was looked upon as a distinct advantage by the engineers of the Great Northern road. It is advantageous to be able to limit the speed of trains going down grade, not so much on account of the energy recuperated as of the simplicity in handling the train and the reduction in the generating station equipment required.

Mr. N. W. Storer called attention to the fact that either three-phase, single-phase or direct-current locomotives offer sufficient advantages over steam locomotives to justify the substitution in many localities. He stated his belief that the substitution will take place just as rapidly as the manufacturing companies of the country are able to handle it.

Mr. W. S. Murray stated that the saving in cost of coal when electric are substituted for steam locomotives should not be ignored, because it represents one of the most important advantages of the former. The following table shows the saving of fuel which will be effected on the New York division of the New York, New Haven and Hartford Railroad when all freight and passenger trains, now operated by steam locomotives, are hauled electrically.

—	Ton-miles per annum.	Tons of coal.		Cost of coal.		Saving. Electric over steam.
		Steam.	Electric.	Steam.	Electric.	
Express	592,240,000	57,447	29,870	$183,830	$89,620	$94,210
Express (local)	348,000,000	58,300	28,600	186,560	85,800	100,760
Freight	2,223,000,000	187,844	139,010	563,530	417,030	146,500
Total ...	3,163,240,000	—	—	—	—	$341,470

The above values have been based on tests of 10 locomotives throughout 18 consecutive days of operation. Express locomotives required 28 lb. of water per indicated H.P.-hour, and freight locomotives 30 lb. The cost of repairs and maintenance average 8·1 cents per locomotive mile in freight service and 5·6 cents in passenger service. An electric locomotive requires about 2 cents per locomotive-mile for repairs.

Mr. Wm. McClellan remarked that it is extremely difficult to obtain reliable data as to the economies that may be obtained by eliminating the steam locomotive.

Prof. C. L. de Muralt gave data showing that a certain double-track road 80 miles in length, which had reached its limit in haulage under steam locomotive conditions, could be equipped with two additional tracks for about $15,000,000, while it could be provided with complete electrical equipment for the former two tracks for about $3,000,000. With the electrical equipment the saving in operating expenses would be about $200,000 out of $8,000,000 per year, while a 40 per cent. increase in traffic could be obtained over the same tracks.

Dr. C. P. Steinmetz stated that the leading conclusion of Mr. Armstrong's paper was that the advantage resulting from electrically equipped steam roads is to be found in the ability of the road with the same trackage to handle a greater amount of traffic. One characteristic of the steam locomotive is that it is essentially a constant power motor. The limit of the electric locomotive is that it can lose only so much power in the motor, to be within sufficient heating limits. Since efficiency rapidly increases with the speed, more power can be obtained at higher speeds up to a certain limit, and, therefore, the electric locomotive is better at the higher speeds than is the steam locomotive; advantage must be taken of this feature if the best results are to be obtained. There must, therefore, be a readjustment, especially of the most important part of the railway; the freight traffic must be readjusted to higher speed. Higher speeds necessarily mean increased service from the system, even without any increased drawbar pull, and even with lesser drawbar pull. In this feature lies the main advantage of electric traction, but it becomes necessary to readjust the method of operation to the changed condition of railroad motive power in order to get the best results out of the electric locomotive.

REVIEWS.

Steam and Exhaust Pipes. By R. McGregor. London: The *Electrical Times*. Price 1s. 6d. net.

This book is a reprint of a very excellent series which appeared in our contemporary, the *Electrical Times*. The author rightly says that pipes are too little considered; he very properly gives his first attention to drainage, and his remarks on the uselessness of water relief valves in cylinders are good. Relief valves are useless, or nearly so, when the engine takes a good gulp of water. The danger of water accumulation due to conical ajutage valves of smaller diameter than the pipe is properly pointed out, as also is the need for pipe drainage, even when the steam in the pipes is superheated, for if priming should take place, there would be small chance of re-evaporation during the short run to the engine.

Next evaporation is dealt with; here again superheat brings in more strenuous conditions, and at 530° F. expansion may amount to $\frac{3}{8}$ in. in 10 ft. Forms of expansion bends are illustrated, and the author shows his correct knowledge by such a remark as "in erecting expansion loops, they should be sprung open to an amount equal to half the estimated expansion." But how often is this done? Yet it is the best of advice to follow.

On the general question of pipe design, we are pleased to see that the ring main is condemned, and at most a balancer pipe is advised to be laid across the boiler branches. This arrangement fulfils all practical requirements, but fails where superheat is wanted. With Lancashire boilers there may be superheaters to each boiler, and the engines can be arranged as illustrated, each directly in line from its own boiler and superheater. Following this comes an illustration of a ring main with its full diameter of pipe throughout, and then is shown the arrangement where a separately fired superheater is placed on the steam main of a whole battery of boilers. In this case each boiler branches into a main of gradually increasing size. Then comes the superheater, and then follows the steam main in the engine room parallel to that in the boiler room, and also gradually diminishing to the endmost engine. But we cannot agree that the arrangement of fig. 27 should be employed. Indeed, fig. 26 would be much improved were the superheater placed in the middle of the battery of boilers, the pipes in both boiler and engine houses tapering each way from the middle point. The feeding of one large engine by several boilers placed in a line at right angles to the engine room enables a separately-fired superheater to be placed close to the engine, and the nearest approach to this with the other system of lay-out is the one just described.

The tendency to-day is towards still larger boiler units with grates of 200 sq. ft. or upwards, all of which implies simpler pipes. We think the author wise in providing some excess of boiler pressure over engine pressure, so as to permit of pipes being kept to a desirable minimum, but we cannot agree that a fall of pressure of any definite amount should be caused by the superheater, though we are aware that some superheaters do give as much as 10 lb., 15 lb. or even a greater loss.

In the remainder of the book will be found flange particulars, and the materials suitable for pipes, and then follow exhaust pipes, a subject the treatment of which is excellent. Some typical installations of pipes are given, and complete what is, in a short space, one of the best little works on steam pipes that has been written.

Steam pipes may be only a detail, and they are a detail too often neglected. But they merit the most careful study, and their design may make or mar a station or an engine.

Coal. By James Tonge. London: Constable & Co. 1907. Price 6s. net.

In this volume of the Westminster series we have a book that deals with that important material, coal, on lines essentially different from anything we have seen before. There is, of course, of necessity, a brief historical account of the use of coal in the world. The Greeks knew of it; so did the Romans, while it is very ancient history with the Chinese. It need hardly be pointed out that coal alone has rendered possible the living of over forty millions of people in the British Isles.

The methods by which Nature has locked up the material from which coal is produced are dealt with by the author in a lucid manner, and the phenomenon of geological faults is explained. The author does not seem to think that our atmosphere was once more highly charged with carbon dioxide than at present, but we cannot see that he evades this, all the same, for if the earth was once too hot for vegetation to live, the carbon now locked up as coal must have been existing as CO_2 in the atmosphere. Where else was it? Where else could it have been? And, what is more to the point, if we burn up all our coal and destroy our forests, will not the atmosphere again become more full of CO_2? We see no escape from this.

There is an excellent and interesting chapter on the fossils of the coal measures, excellently illustrated. As the author says, the labours of Kidston and others serve to indicate the

possibility of determining stratigraphical sequence from the flora alone, and the chapter on the botany of coal-measure plants is very full indeed.

Stratigraphical geological facts rule the next chapter on the coalfields of Britain, and there are many very interesting statistical statements as to area, production, depth, output and duration.

Next follows a chapter on foreign fields and those of the British colonies.

Chapter VIII deals with the classification of coal, its calorific power and analysis. We should hardly class Bovey Tracey lignite as brown coal, for it is very different. Bovey Tracey lignite is too distinctly wooden in properties and appearance to be considered as other than buried wood. It is still as much vegetable in structure as is lower peat. It has been bored through some 60 ft. in one bed at Heathfield, in the centre of the Bovey Clay lake, and is, we believe, unique. It is probably of the Miocene age.

In Chapter X the values of foreign coal are well discussed, and in the next chapter the proportions of the classes of work in the United Kingdom to which coal is put are given. Factories consume the largest quantity, then blast furnaces, gasworks, railways, collieries, steel, &c., works, and steamers—coasting. The domestic supply, however, comes next to the factory use.

There is a good chapter on heat production from coal, including combustion and gas fuel, and in Chapter XIII waste is treated of, both in getting and in use. In Chapter XIV the handling of coal and its preparation for market are fully described, including picking and washing. This is confined to the handling at the bank, and later, for the author leaves mining entirely out of the book, and only takes the coal from the bank. He completes his book with a list of coaling ports and stations of the world, most of which of great importance on the trade routes appear to be in British hands.

This is really an excellent book, and deals in quite a fresh way with its subject.

NEW PATENTS APPLIED FOR, 1907.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

15,100A. "Improvements in or relating to electric secondary clocks." A. C. Stray. (Date applied for under Rule 5 of the Patents Rules, 1905, July 1st, 1907.) November 18th. (Complete.)

25,478. "Improvements in electric fuse-holders." The Electric and Ordnance Accessories Co., Ltd., and R. F. Hall. November 18th.

25,509. "New or improved means whereby, on excess of current in an electrical circuit, the same is automatically broken and completed again by another path after a predetermined interval." S. C. Midwinter. November 18th.

25,511. "Improvements in electric portable photographic lamps." O. T. Banks. November 18th.

25,553. "Improved process for the electric dissociation of metals by the wet method." A. Levy. November 18th. (Complete.)

25,584. "Improved electrical apparatus for the production of light." T. O. Dunford and W. Kirtley. November 19th.

25,585. "Improvements in or relating to interlocked ironclad electric switches." V. Hope, V. H. Sugden and W. H. Gardner. November 19th.

25,607. "Improvements in and relating to electrical connections or conductors." R. B. Hutchison and W. A. Bonnell. November 19th. (Complete.)

25,624. "Improvements in commutating devices." M. Walker. November 19th.

25,630. "Improvements in apparatus for controlling and operating the points of electric railways and tramways." H. L. Turner. November 19th.

25,649. "Improvements in and relating to electric light fittings for use on alternating current." E. R. Grote and the Foster Arc Lamp and Engineering Co., Ltd. November 19th.

25,651. "Improvements in sockets or holders for electric lamps." C. C. Regnart. November 19th.

25,655. "Improvements in processes of manufacturing bodies capable of conducting electricity in a cold state." E. von Siemen. (Date applied for under Patents Act, 1901, November 19th, 1906, being date of application in Germany.) November 19th. (Complete.)

25,663. "Improvements in suspension devices for electric conductors." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) November 19th. (Complete.)

25,664. "Improvements in suspending devices for electric conductors." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) November 19th. (Complete.)

25,666. "Improvements in electric contact-breakers and trembler coils." A. W. Metcalfe. November 20th.

25,667. "Improvements in the manufacture of commutators for dynamos, electro-motors, and the like." W. P. Dreaper. November 20th.

25,668. "Locomotive cab signal-indicator." F. H. Smethurst. November 20th.

25,669. "Improvement in electro-decomposition." L. Haussmann. (Date applied for under Patents Act, 1901, November 23rd, 1906, being date of application in Germany.) November 20th. (Complete.)

25,688. "Improved sanding apparatus for electric train cars or the like." J. Diggle and J. Burrell. November 20th.

25,709. "Improvements in switches for use in connection with intercommunication telephone systems." J. J. Perry. November 20th.

25,716. "Improvements relating to a method of and means for controlling electric appliances in connection with electric circuits." R. F. Venner and R. C. Griesbach. November 20th.

25,733. "Improvements in or relating to electric switches." H. P. Allison and H. J. Arnold. November 20th.

25,740. "Improvements in electrically-operated signalling installations." De Courcy Beamish. November 20th.

25,744. "Improvements in means for varying the potential at two points between which an electric current passes." Felten & Guilleaume-Lahmeyerwerke Act.-Ges. (Date applied for under Patents Act, 1901, November 26th, 1906, being date of application in Germany.) November 20th. (Complete.)

25,752. "Improvements in electric cooking apparatus." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) November 20th.

25,768. "Electrically-operated automatic steam trap." B. A. Malkin and J. D. Robb. November 21st.

25,772. "Improved means of paralleling the motors of electric and petrol-electric cars." W. A. Stevens. November 21st.

25,792. "Improvements in joint-boxes for electric cables." J. Stratton, C. J. Beaver and E. A. Claremont. November 21st.

25,815. "Improvements in and connected with incandescent electric lamps and their fittings." J. H. Collings and H. Hirst. November 21st.

25,830. "Improvements in or relating to electric switches." A. Lorel and The British Ever-Ready Electrical Co., Ltd. November 21st. (Complete.)

25,831. "Improvements in cluster-sockets." G. A. Harter. (Date applied for under Patents Act, 1901, November 22nd, 1906, being date of application in United States.) November 21st. (Complete.)

25,832. "Insulated rail joint." B. Wolhaupter. November 21st. (Complete.)

25,833. "Insulated rail joint." B. Wolhaupter. (Date applied for under Patents Act, 1901, December 6th, 1906, being date of application in United States.) November 21st. (Complete.)

25,834. "Improvements in dynamo-electric machines." The British Thomson-Houston Co., Ltd., and F. H. Clough. November 21st.

25,842. "Improvements in the distribution of electric power by electric transformers." J. T. Irwin, W. E. Ronson and J. L. Cook. November 22nd.

25,846. "Improved electrical gas lighting and extinguishing device." J. M. Stewart and A. G. Rendall. November 22nd.

25,863. "Improvements in means for supporting the trolley wires or conductors of electric tramways." G. R. Feather. November 22nd.

25,864. "Improved device for supporting the trolley wires or conductors of electric tramways." G. R. Feather. November 22nd.

25,878. "Improvements in distribution of electricity." W. J. Davy. November 22nd.

25,881. "Improvements relating to electric arc lamps." D. Suchostawer. November 22nd.

25,902. "Improvements in and relating to the cooling of dynamo-electric machines." The Phœnix Dynamo Manufacturing Co., Ltd., and R. Pohl. November 22nd.

25,911. "Improvements relating to telephone circuits," C. M. Jacobs. November 22nd.

25,912. "Improvements relating to telephone circuits." C. M. Jacobs. November 22nd.

25,919. "Improvements in and relating to electricity generators." J. Ferguson. November 22nd. (Complete.)

25,922. "Improvements in insulated electric conductors and processes of forming the same." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) November 22nd.

25,953. "Improvements in or connected with electrical switches." C. J. Turner. November 23rd.

25,961. "Automatic sand-valve opener for tramcars and other electrically-driven vehicles." F. J. S. Hosken. November 23rd.

25,967. "Improvements in load equalisers for alternating current supply circuits." P. M. Lincoln. (Date applied for under Patents Act, 1901, December 3rd, 1906, being date of application in United States.) November 23rd. (Complete.)

25,970. "Improvements in telephone receivers." K. E. Ericsson. November 23rd.

25,978. "Improved cable or telegraph code." F. Pain. November 23rd. (Complete.)

25,985. "Improvements in and relating to apparatus for roasting and sintering ores." A. S. Dwight and R. L. Lloyd. November 23rd. (Complete.

25,987. "Improvements in connection with the brake-operating mechanism of electric lifts or hoists or the like." Felten & Guilleaume-Lahmeyer-Werke Act.-Ges. (Date applied for under Patents Act, 1901, November 24th, 1906, being date of application in Germany.) November 23rd. (Complete.)

25,998. "Improvements in electrically-operated winches." Aarhus Dynamo and Elektromotor-Fabrik and S. P. Johansen. November 23rd.

25,999. "Improvements in electromotors." Aarhus Dynamo and Elektro-motor-Fabrik and S. P. Johansen. November 23rd.

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool price, post free, 9d. (in stamps).

1906.

Telephonic Transmitters. E. A. Graham. 17,086. July 23th.

Electric Signalling Apparatus for Use on and in Connection with Railway Locomotive Engines and the like. A. C. Bouneviale. 19,378. August 30th.

Electric Motor Control Systems. British Thomson-Houston Co. (General Electric Co., United States.) 23,896. October 26th.

Electric Current Converting Dynamo-Electric Machines. British Thomson-Houston Co. (General Electric Co., United States.) 24,336. October 31st.

1907.

Method and Apparatus for Producing a Desired Distribution of Magnetic Flux in Motors, Generators and other Electrical Apparatus. R. D. Mershon. 4,175. February 19th.

Holders for Incandescent Electric Lamps. L. G. J. Epps. 4,419. Februar 22nd.

Apparatus for Electrically Operating and Controlling Semaphore Signals. Siemens Bros. & Co. and L. H. G. Ferreira. 5,748. March 7th.